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QUARTERLY
OF THE

NATIONAL FIRE PROTECTION ASSOCIATION

"To Promote the Science and Improve the Methods of Fire Protection and Prevention."

PUBLISHED QUARTERLY AT BOSTON, MASS., BY THE
NATIONAL FIRE PROTECTION ASSOCIATION

Printed in U. S. A.

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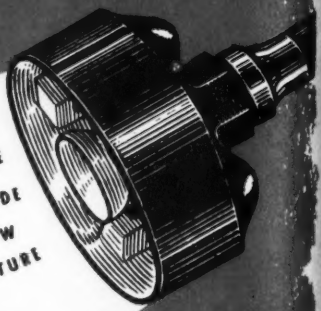

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Vol. 35 January, 1942 No. 3

QUARTERLY

OF THE

National Fire Protection Association

Subscriptions to the QUARTERLY are accepted only as a part of the general publications of the Association which are sent to members. Associate membership is open to anyone interested; annual dues $10.

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National Fire Protection Association

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A NON-PROFIT TECHNICAL AND EDUCATIONAL ORGANIZATION

To promote the science and improve the methods of fire protection and prevention.

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Texas Inspection Bureau.
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United States Conference of Mayors.
Virginia Insurance Rating Bureau.
Washington Surveying and Rating Bureau.
Western Actuarial Bureau (Fire).
Western Canada Insurance Underwriters' Association.
Western Factory Insurance Association.
Western Sprinkled Risk Association.
Western Underwriters Association.
West Virginia Fire Underwriters' Association.
West Virginia Inspection Bureau.

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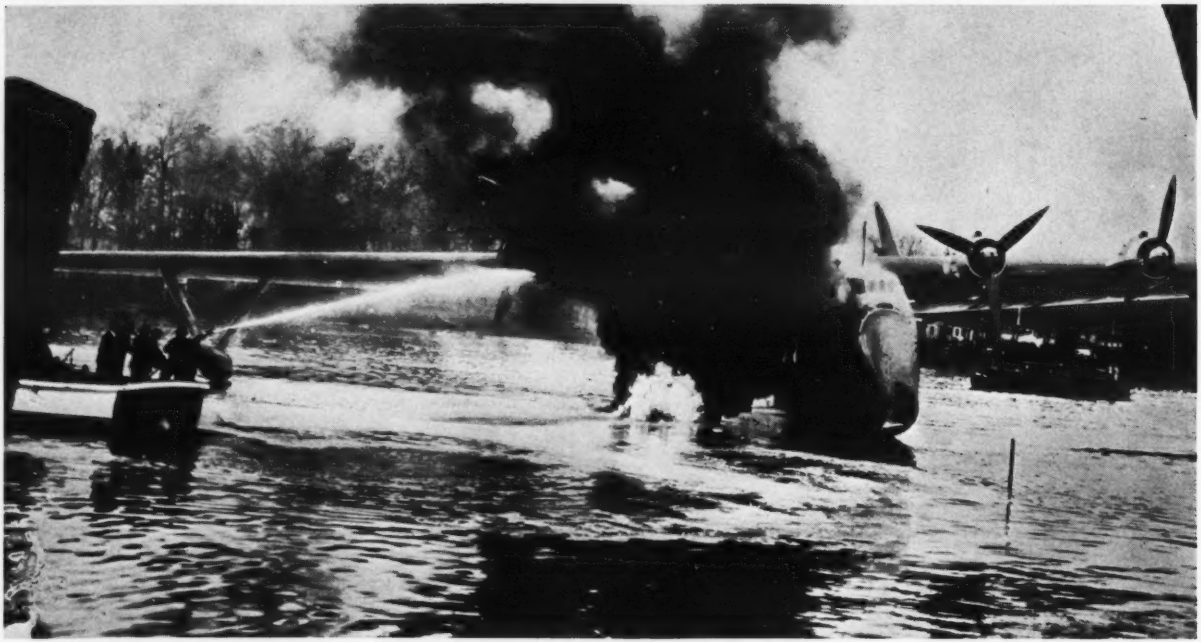
Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.



International.

Fire is a most serious menace to war equipment and defense production facilities. This picture shows a Navy plane which took fire while being tested near Baltimore. This plane was reported as the world's biggest flying boat. The fire fortunately was extinguished before great damage was done.

The Quarterly

Vol. 35 January, 1942 No. 3

Fire and War The actual state of war in the United States places added emphasis upon the importance of fire protection in its various phases, but indicates little or no change in the character of the fire safety measures advocated in the columns of the QUARTERLY and other N.F.P.A. publications during the past year. The fundamentals of fire protection remain the same, and while there are various added precautions to be taken against air raid fires and sabotage, fire protection measures designed for peace-time conditions are equally valuable in time of war. The manufacturing plant, or city, which has adequate peace-time fire defenses in the form of fire-safe construction, limitation of areas or values subject to a single fire, and alarm and extinguishing facilities has made an excellent start in preparation for war incendiarism. Places that have been oblivious of fire safety in peace time are vulnerable to fire in time of war unless much more is done than merely employing additional guards. Also, places that have relied exclusively upon fire prevention educational campaigns without corresponding attention to fire protection are ill equipped to combat war incendiarism.

* * * * *

Protection for War Production Production of airplanes, ships, tanks, and other munitions of war is the first objective of our war effort. Nothing must interfere with this vital production, least of all fire. Many plants are reasonably safe from the danger of any serious interruption to production by fire, accidental, incendiary, or air raid set, but many more are vulnerable to fire because no adequate thought has been given to fire safety prior to the present emergency. Even now the general understanding of the importance of fire protection for war industries is far from what it should be.

In our opinion adequate fire protection for all war industries and stores of essential materials should be the first objective, and should take precedence over ordinary civilian protection in any case where shortages of equipment make it impossible to protect both. Furthermore, we believe that under present conditions the greatest danger to war production facilities and essential material stores is neither from enemy agents nor bombing planes, but from fires of accidental origin. We accordingly recommend that in the safeguarding of war industries and material stores the very first consideration should be the

standard, time-tested measures of fire protection, particularly the segregation of values subject to a single fire, and automatic protection. Additional precautions against war incendiarism should be superimposed on the fundamental fire protection program, never substituted for it. Standard fire protection is effective in limiting the damage from fire of any cause, accidental, sabotage, or incendiary bombing.

* * * * *

Air Raid Fire Safety

As a result of British experience, and studies by American and Canadian engineers, much information is already available on methods of protection during air raids. Techniques for the control of incendiary bombs are now well known, information is available on the principles of the blackout, plans can be secured for the construction of air raid shelters designed to withstand the effects of explosive bombs, and there is knowledge of the methods for limiting the effect of demolition bombs. Fire protection engineers, like engineers in other fields, can design protection appropriate for any specified degree of hazard.

But there is no pronouncement from the U. S. Army, the Navy, the Office of Civilian Defense or other authoritative source to indicate the probable extent and character of the air raids for which we are asked to prepare. The management of the individual property, and the local public authorities, must decide for themselves how far to go in providing protection. Sporadic raids lasting fifteen minutes present a problem quite different from the continuous raids to which England has been subjected. Enemy planes dropping incendiaries over a wide area present a condition altogether different from the dropping of high explosive bombs on concentrated objectives, and the measures necessary to provide protection against a 500 lb. bomb are different from those needed for 1000 lb. or larger bombs.

In so far as the preparations to be taken involve only organization, training, and the use of existing equipment and physical facilities it is obviously prudent to provide against any eventuality, but where protection involves the use of materials and equipment thereby diverted from direct military uses it should be put into effect only where absolutely essential. While no one can predict with any certainty, it seems reasonable under present conditions to plan protection on the assumption that if there are any air raids they are likely to be of the sporadic type, lasting a half hour or less, that incendiary and small explosive bombs will be the principal weapon, and that the cities first subject to attack are those within two or three hundred miles of the East, West or Gulf coasts. This is based on the fact that the absence of near-by enemy bases limits attacks to those from planes launched from airplane carriers, or long range bombers from distant bases, either of which limits the number of planes and total bomb load.

Fire Protection in Blackouts

The blackout brings many new fire protection problems to North American cities. The British experience, while helpful in certain aspects of these problems, does not provide the answer to various troublesome questions. Thus far practically all of the attention to the blackout problem has necessarily been concentrated upon the main objective of securing an effective complete blackout. The publication of the Office of Civilian Defense, Washington, D. C., entitled "Blackouts" provides a comprehensive discussion of the theory and practice of blackouts, with practical suggestions as to methods, but except for a warning against the use of flammable materials such as nitrocellulose film on windows, and a caution against obstruction of emergency exits, this publication is virtually silent on the various fire protection problems of the blackout in which N.F.P.A. members are most interested.

The first consideration is the effective operation of municipal fire departments and auxiliaries under blackout conditions. Automobile headlights are very conspicuous from the air and in blackouts all automobile lights, even of emergency vehicles, must be drastically restricted. Only very dim lights are allowed, which means that speeds must be reduced, with consequent lengthening of the interval between the alarm and the arrival of the apparatus at the fire.

Where blackouts are instituted prior to the completion of an air raid system organization, and reliance is placed upon the normal peace-time alarm procedures, the problem arises as to how to find the street fire alarm box in total darkness. Fire alarm box marking lights, such as are used in many large cities, must be turned off in a blackout. White paint will help in locating boxes, except under snow conditions, and luminous markings may be used, but no such expedient will make the box visible from any great distance, and fire alarm boxes thus appear likely to be of limited value except where people are so familiar with box locations in their vicinity that they can find boxes in the dark.

Prompt fire extinguishment is of even greater importance during air raids than in normal times, because a fire furnishes illumination so that enemy bombers can find their targets. This applies not only to fires set by incendiary bombs, but also to fires from accidental causes, and to fires set by enemy agents who can operate with less fear of detection under blackout conditions.

Floodlighting the exterior of important industrial buildings has been widely recommended and practiced as a measure to facilitate the work of guards and watchmen in preventing the approach of unauthorized persons bent on arson or sabotage. Floodlighting and blackouts are manifestly inconsistent, but many authorities rely mainly on floodlighting, without apparent thought to the prevention of access by potential saboteurs during blackouts. Floodlighting is obviously desirable, but it is a mistake to place sole reliance upon it. Automatic detection equipment operating on the electric eye principle and

using ultra-violet or infra-red light may be continued in operation during blackouts.

The floodlighting equipment provided by fire departments to furnish illumination for night fire fighting cannot be used during blackouts. Some fires themselves provide all too ample light, but this cannot be relied upon by the firemen. All of this means that fire departments should be able to operate effectively in total darkness. With sufficient practice, such as few fire departments have had as yet, most of the operations of raising ladders, connecting hose and the like can be performed in darkness, but the over-all efficiency of fire fighting operations must inevitably suffer. White or luminescent paint on parts of apparatus, and luminescent bands on firemen's uniforms may help, but there is still much to be done in working out the details. Suitable paint will help in locating hydrants, but there is no way to see and locate fire in a building by looking through blacked out windows.

Owing to the probable delays in blackout fire fighting by public fire departments, as well as the probability of a much greater number of incendiary bomb fires than can be handled simultaneously by the municipal fire fighting forces, private fire protection is of major importance, and here again the blackout brings special problems. In the large factory or institution with a private yard hydrant system and organized fire brigade the situation is closely parallel to that in the public fire department.

Where windows are blacked out, and the normal interior lighting continues during blackout, ordinary interior fire fighting will be the same as under normal conditions. However, very few buildings to date have been provided with blackout protection for windows, and in case of air raids at night it will be necessary to put out all interior lights. How then are extinguishers, hand hose, and interior fire alarm boxes to be located? Luminescent markings seem to provide the best available answer. Low intensity lights screened from overhead visibility may also be used for this purpose, and to mark exits.

Luminescent paints are of two types, those utilizing radioactive materials which will glow indefinitely, and those which depend upon the excitation of some external light source. The latter type is much less expensive and avoids the danger of poisoning from radium and related compounds and the personal hazard from continued exposure to radium radiation. These luminescent ("phosphorescent") paints continue to emit a glow for hours after they have been exposed to sunlight or a bright artificial light. They also emit a visible glow while exposed to radiation from an invisible light source of ultra-violet light. Such materials are commercially available as the result of their use for advertising signs and posters. In a form resembling oilcloth this material may be tacked up to mark fire fighting equipment, exits, etc., or may be sewed on firemen's clothing.

Meeting of Board of Directors.

Atlantic City, January 17, 1942.

Present.

Albert T. Bell, Chairman
Alvah Small, President
David J. Price, Vice-President
Richard E. Vernor, Vice-President
A. L. Brown
H. T. Cartlidge
Frank A. Epps
Russell Grinnell
C. C. Johnson
C. W. Johnson
W. E. Mallalieu
Hovey T. Freeman, Secretary-Treasurer
Samuel D. McComb, Past President
George W. Elliott, Past President
H. L. Miner
C. W. Pierce
W. J. Scott
H. Sidney Smith
W. C. Wagner
John L. Wilds

Percy Bugbee, General Manager
Robert S. Moulton, Technical Secretary
Horatio Bond, Chief Engineer
John A. Neale, Chairman, N.F.P.A. Committees on Protection of Openings in Walls and Partitions, and Signaling Systems and Thermostats.

1. The program for the 1942 annual meeting was considered, and referred to the Program Committee with power.

2. A proposal from the National Electrical Manufacturers Association for a change in the date of the 1942 annual meeting was considered, and the General Manager was instructed to communicate with N.E.M.A. expressing regret that it is not practicable to change the date of the meeting.

3. Technical Secretary Moulton reported on the status of N.F.P.A. membership, reporting a total membership as of January 1 of 5743, the largest in N.F.P.A. history, and making reference to the activities of President Small, and particularly Membership Committee Chairman Rainey in bringing new members into the Association.

4. General Manager Bugbee reported on advertising in N.F.P.A. publications, indicating a satisfactory increase in advertising revenue.

5. Technical Secretary Moulton reported on publications, indicating very gratifying distribution of N.F.P.A. literature, particularly of the several current items directly pertaining to the fire protection of war industries, and civilian defense.

On motion of Mr. Grinnell, it was voted to refer to the General Manager, with power, suggestions for the abridgement and limited distribution of the 1942 Proceedings in the interest of economy and conservation of paper.

A vote of appreciation was extended to the N.F.P.A. staff for their work in preparation of the new publication "Employee Organization for Fire Safety."

6. Chief Engineer Bond reported on the activities of the N.F.P.A. Field Engineering Staff in connection with national defense. There followed a general discussion of fire protection in connection with war activities, with particular reference to the protection of piers and wharves, stockpiles of essential materials, manufacturing facilities, the activities of the Office of Civilian Defense and other governmental agencies, defense councils and local air raid organizations. After this discussion it was voted to offer to the Office of Civilian Defense the full coöperation of the N.F.P.A. and authorize the General Manager to make official contact with the O.C.D. to effectuate such coöperation as may be of assistance to them.

7. General Manager Bugbee reported on the Fire Marshals Section, recording the untimely death of Chairman Lindemeyer.

8. Chief Engineer Bond reported on the Volunteer Firemen's Section, the magazine VOLUNTEER FIREMEN, and the plan to continue meetings of this group in connection with the N.F.P.A. annual meeting.

9. Treasurer Freeman reported on the current finances of the N.F.P.A., indicating a very satisfactory financial condition. On motion of Mr. Freeman, it was voted to refer to the Finance Committee, with power, the paying of a "cost of living" bonus to N.F.P.A. employees.

10. On recommendation of the Advisory Committee, it was voted to continue the $2 registration fee at the annual meeting.

11. Consideration was given to a report on the publications policy of the Association prepared by the N.F.P.A. staff at the request of the Advisory Committee, to which proposals by President Small for changes in policy for the QUARTERLY and other N.F.P.A. publications had been referred by the Board at its last meeting. It was voted to approve a staff proposal for the printing of the NEWS LETTER in a new form, and to continue the QUARTERLY and other N.F.P.A. publications in their present form, and with the same editorial policy.

12. Consideration was given to a memorandum prepared by General Manager Bugbee at the request of President Small, outlining the N.F.P.A. contacts and coöperation with the International City Managers Association, with particular reference to a correspondence course in Municipal Fire Administration described in a circular sent to N.F.P.A. members with the November NEWS LETTER. It was voted to receive this report, and to record the opinion that the Board saw no reason for change in the present policy of staff coöperation with the International City Managers Association.

13. The report of the Committee on Technical Committee Procedure, presented by Chairman Pierce, was adopted, including approval of the following; also confirmation of the technical committee appointments recommended by the Committee on Technical Committee Procedure as recorded in Minute No. 19.

(*a*) Continuance of the Committee on Protection against Lightning, with the appointment of a new chairman to succeed the late Dr. Morton G. Lloyd, and additions to personnel to include certain groups not now represented.

(*b*) Approval of a revised plan of organization of the Committee on Fire Protection and Fire Resistance for which the N.F.P.A. is joint sponsor with the National Board of Fire Underwriters and the National Bureau of Standards under the procedure of the American Standards Association (A.S.A. Project A51.) [See Minute 14 (d), June, 1941, meeting of Board of Directors, July, 1941, QUARTERLY, page 12.]

(*c*) Continuance of N.F.P.A. coöperation in the A.S.A. Building Code project, in so far as this will not involve diverting time and energy from activities of immediate value in connection with war production and civilian defense.

(*d*) Acceptance of the Underwriters' Laboratories, Inc., standard on Power Operated Radio Receiving Appliances for the purposes of its approval by the American Standards Association under the proprietary sponsorship procedure.

(*e*) Approval of the policy of concentrating attention upon committee activities having immediate application to the safeguarding of war production facilities, storage of essential material and civilian defense, and the advancing of other projects only to such extent as can be done without interference with activities of immediate importance in connection with the war effort.

(*f*) Approval of the policy of handling emergency changes in N.F.P.A. standards necessitated by war conditions as interim amendments subject to confirmation at the next annual meeting, each case to be handled by the Committee on Technical Committee Procedure on its individual merits.

14. A request from the Edison Electric Institute for reconsideration of the action of the Electrical Committee with respect to so-called Type S fuses was discussed and referred to the Electrical Committee for consideration in the light of the exigencies of the present national emergency. [See October, 1941, QUARTERLY, page 109.]

15. On recommendation of the Committee on Electrical Field Service, the following statement as to the objectives of the committee, as effected through its Electrical Field Engineer, was approved:

Scope of Electrical Field Service Committee Activities.

1. To promote observance of the National Electrical Code by all enforcing authorities as an adequate standard for the practical safeguarding of life and property from electrical hazards.

2. To promote the uniform application of the National Electrical Code without modification, and in general to discourage special rules at variance with those of the National Electrical Code.

3. To promote the latest edition of the National Electrical Code, and its adoption replacing previous and obsolete editions in all jurisdictions.

4. To promote uniform interpretation and understanding of the National Electrical Code by enforcing authorities and other users.

5. To promote approval by enforcing authorities of electrical equipment listed as meeting the requirements of the National Electrical Code, and to discourage setting up requirements for special equipment serving only local demands.

6. To promote the general acceptance of recognized wiring methods, including any newly adopted in the National Electrical Code.

7. To explain to inspection authorities and other users of the National Electrical Code the intent and reasons for Code requirements, particularly those newly adopted.

8. To obtain from the field the results of experience with the National Electrical Code with recent revisions in particular.

9. To act as Secretary of the Electrical Committee.

10. To obtain field opinions regarding the need for proposed amendments to the National Electrical Code, whether additions or modifications.

11. To convey to the Article Committees of the Electrical Committee all proposals for new or modified code requirements.

12. To advise Article Committees concerning field experience with respect to such additions or modifications.

16. On recommendation of the Committee on Special Extinguishing Systems, the following revised wording of Section 19 of the Standards on Carbon Dioxide Fire Extinguishing Systems was adopted:

19. Pipe Systems.

(*a*) All pipe and fittings made of ferrous material shall be protected inside and out against corrosion and shall be free from scale.

(*b*) Piping shall be arranged so as to reduce friction to a reasonable minimum. Pipe lines should be run in the shortest possible course and unnecessary fittings avoided. All piping shall be reamed and cleaned before assembly, and after assembly the entire pipe system shall be blown out before discharge orifices are installed. All dead end lines shall extend at least 2 in. beyond the last orifice and shall be closed with a cap or plug.

(*c*) All piping shall be securely supported and where necessary, protected against injury. In rooms where explosions are possible the piping shall be hung from other supports than roofs, floors and partitions which are subject to displacement.

(*d*) Pipe sizes shall conform to the requirements as given in these rules under the various classes. (See Articles 35, 44 and 55.)

(*e*) High pressure systems — All pipe and fittings shall have a minimum bursting pressure of 6000 lbs. per sq. in.

(*f*) Low pressure systems. For systems protected by relief valves set at not over 375 lbs. per sq. in. and with automatic controls designed to keep container pressures below 305 lbs. per sq. in. the following provisions apply:

(1) All steel or wrought-iron pipe shall be of standard weight, or heavier. Any other pipe or tubing, if used, shall be at least equivalent to standard weight steel pipe in strength and resistance to mechanical injury.

(2) If malleable-iron fittings are used they shall be of the 300-lb. working pressure class (300-lb. steam rating). If fittings are made of any other material they shall at least have equivalent strength. Cast-iron fittings shall not be used.

(3) The piping shall be so arranged and have valves of such design to prevent the entrapment of liquid carbon dioxide and consequent development of pressure in excess of 375 lbs. per sq. in. Otherwise the piping between valves, wherein the liquid can be trapped, shall be equipped with relief devices of adequate capacity and these devices shall be set for 375 lbs. per sq. in. pressure.

17. On recommendation of the Committee on Signaling Systems and Thermostats Section 331 of the Standards for Proprietary, Auxiliary and Local Systems for Watchman, Fire Alarm and Supervisory Service was amended by adding to the first sentence in the section the following: "except that the inspec-

tion department having jurisdiction may, upon application, waive this specific indication where the area, height or special conditions of occupancy are such that this indication is not deemed to be an essential feature of thermostatic protection of the property."

18. Mr. Wilds reported plans for the conduct of a research on fire gases by the Northwestern Institute of Technology. The Board registered commendation of the objectives of this research project, and requested Mr. Wilds to maintain contact with it on behalf of the Association.

19. The following committee appointments were confirmed, also the appointments made since the June meeting of the Board and incorporated in the 1941 Year Book in accordance with the authority delegated to the Committee on Technical Committee Procedure.

Automatic Sprinklers.

R. H. Osborne, Western Actuarial Bureau (replacing R. M. Beckwith).

Dust Explosion Hazards.

Dean M. Clark, Society of Grain Elevator Superintendents of North America (replacing James Hayhoe).

Electrical.

E. E. Turkington, Associated Factory Mutual Fire Insurance Companies (replacing G. S. Lawler, deceased).

Electrical Field Service.

K. W. Adkins, International Association of Electrical Inspectors.

Fire Pumps.

H. G. Jordan, Western Factory Insurance Association.
R. H. Osborne, Western Actuarial Bureau (replacing R. M. Beckwith).

Firemen's Training.

Chief Samuel J. Pope, V. P., International Association of Fire Chiefs.

Flammable Liquids.

L. E. Antene, Oklahoma Inspection Bureau (replacing C. T. Ingalls, deceased).

Protection Against Lightning.

C. W. Caskey, Ontario Fire Marshal's Office.

Signaling Systems and Thermostats.

K. H. Parker, Western Actuarial Bureau (replacing R. M. Beckwith).

Special Extinguishing Systems.

Charles A. Getz, Cardox Corporation.

American Standards Association.

Committee on Emergency Standard for Flood Lighting — V. H. Tousley.
Committee on Performance Requirements for Protective Occupational Footwear—Z-41 —H. L. Miner.

20. It was voted to hold the June meeting of the Board in Boston on a Monday. On recommendation of the Advisory Committee it was voted that all living past presidents be invited to attend the June meeting of the Board as guests and with the privileges of the floor, but without voting power.

21. It was voted to instruct the General Manager in the name of the Board to send greetings and best wishes to Chief W. W. Blaisdell of the Honolulu Fire Department (member N.F.P.A.), whose letter to General Manager Bugbee recounting the experiences of his department in the Japanese air raid on December 7 had been read to the Board.

The 1941 Fire Loss.

The fire loss in the United States for the year 1941 is $322,357,000, according to a preliminary estimate by the National Board of Fire Underwriters. This total estimate is $15,887,480, or 5.2% more than the 1940 preliminary loss estimate, and shows increased losses over 1940 in all but the first two months of the year.

Comparative Monthly Loss Estimates, 1939, 1940, 1941

	1939	1940	1941
January	$27,615,316	$36,260,650	$26,470,000
February	29,303,520	34,410,250	26,102,000
March	30,682,168	29,788,800	31,471,000
April	27,061,522	26,657,190	29,330,000
May	27,031,700	23,446,590	25,637,000
June	24,190,700	19,506,000	24,943,000
July	22,468,304	20,322,800	23,698,000
August	22,800,500	20,722,100	24,122,000
September	22,837,250	21,198,000	24,668,000
October	24,300,500	22,091,140	30,833,000
November	27,248,160	23,449,000	23,822,000
December	27,959,200	28,617,000	31,261,000
Total 12 months	$313,498,840	$306,469,520	$322,357,000
Adjusted loss figures (Released later in year)	$274,943,000	$268,491,347	

Aggregate Loss for 26 Years Is Over Ten Billion Dollars.

The 1941 fire loss brings the total fire waste in the United States during the past twenty-six years up to $10,104,504,615, an annual average of almost $390,000,000. The following table gives the annual fire losses by years since 1916, the first year for which similar estimates were made.

1916	$258,377,952	1929	$459,445,778
1917	289,535,050	1930	501,980,624
1918	353,878,876	1931	451,643,866
1919	320,540,399	1932	406,885,959
1920	447,886,677	1933	271,453,189
1921	495,406,012	1934	271,197,296
1922	506,541,001	1935	235,263,401
1923	535,372,782	1936	266,659,449
1924	549,062,124	1937	254,959,423
1925	559,418,184	1938	265,591,231
1926	561,980,751	1939	274,943,000
1927	472,933,969	1940	268,491,347
1928	464,607,102	1941 (Est.)	322,357,000

NOTE. It may be noted that the final loss figures for both 1939 and 1940 are less than the preliminary loss figures for those years. It may be assumed, therefore, that the adjusted loss figure for 1941 will also be lower than the preliminary estimate.

Large Loss Fires, 1941.

According to the reports received by the N.F.P.A. Department of Fire Record, forty-eight fires occurred during 1941 in the United States and Canada each of which involved a loss estimated at $250,000 or more. Six of these occurred in Canada. This represents an increase of ten fires over the number reported for 1940 and is twelve greater than the average for the past five years. The locations of these fires are indicated on the annual conflagration map (see page 200). Twenty of these fires caused individual losses of not less than $500,000, including thirteen which resulted in losses of more than $1,000,000 each. The largest fire of the year and the largest single industrial loss in any year was the fire which destroyed the property of the Firestone Rubber and Latex Products Co. at Fall River, Mass., on October 11, 1941. The loss in this case approximated $11,000,000.

A total of fifty lives were lost in these fires. This is twenty-one less than were lost in the corresponding fires of 1940.

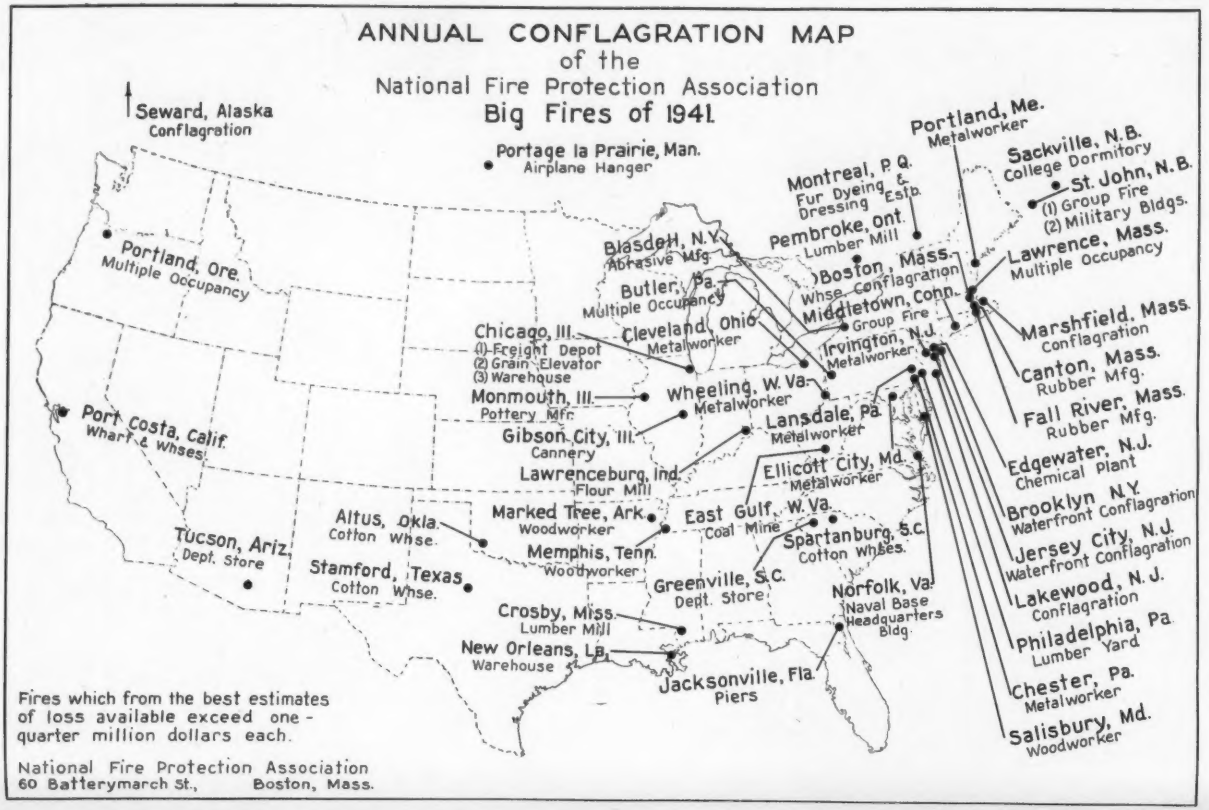
The following table shows the occupancies which were involved:

Metal workers	7	Canneries	1
Warehouses	6	Office buildings	1
Lumber yards and woodworkers	6	Motor express terminal	1
Piers and wharves	4	Fur dressing and dyeing	1
Multiple occupancies	5	Airplane hangars	1
Conflagrations	3	Flour mills	1
Department stores	2	Grain elevators	1
Rubber manufacturing	2	Chemical plant	1
Miscellaneous manufacturing	2	Dormitories	1
Group fires	1	Coal mining property	1

A summary of each of these fires is presented below to show the factors responsible for each large loss so far as the information is available. The loss figures used are in most cases adjusted figures or authoritative estimates.

January 10, Gibson City, Ill. Gibson City Canning Co. Loss: $250,000.

Fire of undetermined origin destroyed three buildings of this canning factory together with their contents, which consisted of canned food products. Two other buildings were also damaged. The buildings involved were one and two-story brick-joist structures with composition roofs on wood sheathing. The fire was discovered shortly after midnight by a watchman. His attempts to telephone the alarm were futile because the fire had burned the wires. A near-by resident, however, noticed the fire, and running to a restaurant, transmitted the alarm to the telephone operator, who sounded the siren calling out the volunteer fire department. This procedure resulted in a delay of some six minutes, during which time the fire gained considerable headway. The fire spread from the building where it originated to the adjacent buildings through unprotected openings in the division wall. Outside aid was summoned from other towns. Most of the nine fire streams used were one and one-half inch lines because of the limited number and location of the hydrants and the capacity of the mains serving them. According to fire flow tests previously conducted, only sufficient water to supply three standard two and one-half inch hose streams was available. The direct property loss from this fire was $238,000. The indirect losses which must be taken into account, however, bring the total loss to at least $250,000. One estimate from an authoritative source places the total loss at $300,000, but insurers of the property state that this estimate is excessive, while declining to submit loss figures for publication.


ANNUAL CONFLAGRATION MAP
of the
National Fire Protection Association
Big Fires of 1941
Seward, Alaska
Conflagration
Portage la Prairie, Man.
Airplane Hanger
Portland, Ore.
Multiple Occupancy
Port Costa, Calif.
Wharf & Whses.
Tucson, Ariz.
Dept. Store
Altus, Okla.
Cotton Whse.
Stamford, Texas
Cotton Whse.
Chicago, Ill.
(1) Freight Depot
(2) Grain Elevator
(3) Warehouse
Monmouth, Ill.
Pottery Mfr.
Gibson City, Ill.
Cannery
Lawrenceburg, Ind.
Flour Mill
Marked Tree, Ark.
Woodworker
Memphis, Tenn.
Woodworker
Crosby, Miss.
Lumber Mill
New Orleans, La.
Warehouse
Blasdell, N.Y.
Abrasive Mfg.
Butler, Pa.
Multiple Occupancy
Cleveland, Ohio
Metalworker
Wheeling, W. Va.
Metalworker
Lansdale, Pa.
Metalworker
Ellicott City, Md.
Metalworker
East Gulf, W. Va.
Coal Mine
Greenville, S.C.
Dept. Store
Jacksonville, Fla.
Piers
Montreal, P.Q.
Fur Dyeing & Dressing Estp.
Pembroke, Ont.
Lumber Mill
Boston, Mass.
Whse. Conflagration
Middletown, Conn.
Group Fire
Irvington, N.J.
Metalworker
Spartanburg, S.C.
Cotton Whses.
Norfolk, Va.
Naval Base Headquarters Bldg.
Portland, Me.
Metalworker
Sackville, N.B.
College Dormitory
St. John, N.B.
(1) Group Fire
(2) Military Bldgs.
Lawrence, Mass.
Multiple Occupancy
Marshfield, Mass.
Conflagration
Canton, Mass.
Rubber Mfg.
Fall River, Mass.
Rubber Mfg.
Edgewater, N.J.
Chemical Plant
Brooklyn, N.Y.
Waterfront Conflagration
Jersey City, N.J.
Waterfront Conflagration
Lakewood, N.J.
Conflagration
Philadelphia, Pa.
Lumber Yard
Chester, Pa.
Metalworker
Salisbury, Md.
Woodworker
Fires which from the best estimates of loss available exceed one-quarter million dollars each.
National Fire Protection Association
60 Batterymarch St., Boston, Mass.

The aftermath of the fire which on January 26, 1941, destroyed the inadequately protected administration and communications building of the naval station at Norfolk, Va., with a loss of $275,000. The cause of the fire was not revealed, but it was reported that a quantity of official documents, including the records of 10,000 service men, were consumed by the flames.

January 26, Norfolk, Va. U. S. Naval Operating Base. Loss: $275,000.

The administration and communications building of this large Naval station was severely damaged by fire which started in the radio room. It is reported that a quantity of official documents, including the records of 10,000 service men, were destroyed. The cause of the fire was not stated, but available information indicates the point of origin and that the fire spread rapidly through the auditorium. The fire was fought by the three base fire companies and by four companies from the Norfolk Fire Department. A loss estimate of $275,000 was made by the Commandant of the Naval Training Station, who also expressed the opinion that replacement of the structure would involve a capital investment of upwards of $500,000.

January 31, Chicago, Ill. Silver Fleet Motor Express Co. Loss: $250,000.

A spectacular fire virtually destroyed this freight depot, together with twenty-six trucks loaded with merchandise. The building was a single story brick structure of approximately 31,000 square feet in floor area without subdivisions and with a felt and gravel roof on wood joists and sheathing. The fire started when the driver of one of the large transport trucks, which was parked inside the building, allowed the truck gasoline tank to overflow as he was filling it from a pump, also located inside the building. His hobnailed shoes struck a spark which ignited the gasoline vapors. The fire spread with great rapidity and the entire building was involved when the fire department arrived. Four alarms were sounded. The fire prevention bureau reports that the management of this property was apparently completely oblivious of the possibility of fire. No precautions were taken nor were first-aid fire appliances of any kind to be found on the premises. There was great congestion of trucks and freight, and that, coupled with the rapid spread of the flames, made salvage operations during the fire impossible.

February 12, Stamford, Texas. C. A. Douthit Warehouses. Loss: $250,000.

Fire destroyed two frame metal-clad cotton warehouses and contents consisting of some 3900 bales. Cause of the fire was not determined, but as a blinding dust storm was in progress with wind of from 50 to 60 m.p.h., the source of ignition could have originated at a considerable distance and been blown to the cotton unobserved. Some distance to windward of the warehouses was a cotton gin where cotton burrs were being burned as furnace fuel, and

National Fire Protection Association
60 Batterymarch St., Boston, Mass.

The building pictured above was one of the several warehouses of the Bienville Corporation, New Orleans, La. It was of unsprinklered, four-story, brick-joist construction, and the loss of the warehouse and its contents in this fire of March 12, 1941, amounted to $1,285,345. The wall, which was falling just as this picture was taken, injured several firemen and foretold the building's total destruction.

also in overflow pits. The opinion has been expressed that this was the source of the fire. The warehouses were each about 10,000 square feet in area without inside protection except water barrels and pails. The local part-paid fire department fought the fire and attributed the spread of the fire to the second warehouse to the exceedingly high wind. Weak water supply was also a factor in the loss.

February 9, Butler, Pa. Koch-Schultis Building. Loss: $264,400.

This three-story brick-joist building housing a drug store, a hardware store, several offices and five apartments was destroyed by fire, which started in the basement. It is believed to have originated in the waste paper chute from the drug store. The fire had gained considerable headway when discovered, but was apparently being brought under control by the fire department when an explosion of unstated origin occurred, forcing the firemen to retreat and spreading the fire to the adjoining basement of the hardware store and upward through unprotected vertical openings. Police meanwhile had ushered the residents to safety. A two-inch gas pipe ruptured, adding fuel to the flames, and the intensity of the fire is reported to have been increased by the supply of paints, turpentine and linseed oil stored by the hardware merchant. The firemen were endangered when heat detonated a supply of ammunition. The fire spread to the roof of the adjoining Miller-Kirkpatrick Building, which housed a J. C. Penney Co. department store and several offices. Fire and water damage to this structure was considerable. Other adjacent structures were also damaged after a portion of a wall of the Koch-Schultis building fell, aiding in the spread of the flames.

February 25, St. John, N. B. Military Buildings. Loss: $824,255.

Fire believed due to faulty flues from heating stoves destroyed two frame buildings which were in use by the local militia for offices and the storage of Quartermaster's supplies. One of the buildings was formerly an exhibition hall and was still being altered for use by the militia. The fire originated in a concealed space between floors and spread with great

rapidity. A militiaman lost his life in a futile attempt to save his rifle. The fire alarm siren was sounded promptly but was not taken seriously by some of the occupants because it had been in frequent use for other purposes. The public fire alarm box was pulled at the same time. By the time the fire department arrived the fire was beyond control and the buildings were burned to the ground in an hour and a half. The large loss represents for the most part the high value of the Quartermaster's stores.

March 6, Portland, Ore. Burnett Automotive City Bldg. Loss: $300,000.

The property involved in this fire was a large three-story city block, the principal occupant of which was a garage handling the sales and service of new and used passenger cars. There were also about a dozen other tenants of various occupancies. The structure had concrete walls, but the remainder was of wood, having been remodeled from mill construction. The floors in the garage area were connected by ramps and an open elevator shaft. The fire started during the early morning and had gained considerable headway before it was discovered by a passer-by. The entire second floor was involved when the fire department arrived. The fire is believed to have originated in an automobile on the second floor, due possibly to either an electrical short circuit in the car wiring or to a lighted cigarette on the upholstery. The fire spread from car to car and involved practically the entire building despite the efforts of the fire department, which responded to three alarms.

March 12, Irvington, N. J. Barnett Foundry & Machine Co. Loss: $588,444.

Fire of unknown origin destroyed a single-story corrugated steel-clad frame building used for the storage of wooden patterns. The fire was detected in the early evening by an automatic fire alarm system under central station supervision. The fire department responded promptly, but, because of the highly flammable nature of the contents, the large undivided area involved, and the prevailing wind, they were unable to bring the fire under control until some three hours later. By the time the fire was extinguished the patterns, valued at nearly $570,000, were destroyed.

March 12, New Orleans, La. Bienville Warehouse Corp. Loss: $1,285,345.

The property destroyed by this fire was a large unsprinklered four-story brick-joist warehouse used principally for the storage of bulk foodstuffs such as sugar and flour. The warehouse occupied an area of 33,550 square feet which was not subdivided by fire walls. Vertical openings were frame enclosed. The fire started in a box car which was standing on an adjacent siding. Spontaneous ignition of the rubbish in the car or a carelessly discarded cigarette have been advanced as possible causes. The watchman of some near-by property discovered the fire in the box car and turned in an alarm. By the time the fire department arrived, however, the flames had already spread to the warehouse through plain glass windows in ordinary wooden frames. Two general alarms were immediately sounded, but there was little the fire department could do to save the structure. Less than an hour later the first wall collapsed, followed by the remaining walls shortly thereafter. Several buildings located across the street from the warehouse were damaged by fire and water. The night watchman of the warehouse was not aware of the fire until the fire department was arriving. He was expected to watch not only the warehouse where the fire occurred, but also another similar structure, connected to the first by an enclosed passage at the second floor level. Fire doors at this passageway prevented the fire from spreading to the second warehouse. (April, 1941, QUARTERLY, page 352.)

March 18, Montreal, P. Q. A. Hollander & Son, Ltd. Loss: $600,978.

Six persons lost their lives, about sixty others were injured, and nearly a half million dollars worth of furs were destroyed in an explosion and fire which severely damaged this fur dyeing and dressing establishment. The property involved consisted of two adjoining and communicating brick and timber buildings, equipped with automatic sprinklers. The explosion occurred without warning on the second floor of one of the buildings where the cleaning and bleaching of furs was carried on. Sections of the walls of this and the adjoining building were blown out. It is reported that nearly 500 sprinklers operated and, despite the fact that the system was partly crippled by the blast, contributed materially toward controlling the ensuing fire. The consensus is that the explosion was due to the ignition of vapors from gasoline used with sawdust in fur cleaning. Whether ignition took place from an electrical short circuit or by a back draft from the furnace is not definitely known. The furnace was fed dirty sawdust from a bin supplied through a chute connecting with the second floor. In view of the severe gasoline hazard, the lack of explosion-proof electrical equipment, and the absence of any protection against static electricity, it is not surprising that this explosion occurred.

The ice-hung ruins of the A. Hollander & Son, Ltd., fur dyeing and dressing establishment in Montreal, P. Q., are a tragic monument to the loss of six lives and more than $600,000 brought to the plant by an explosion and fire on March 18, 1941. The ignition of gasoline vapors is agreed to have been the cause of the tragedy, but the exact circumstances of the fire's start are not known. Although the sprinkler system was crippled by the blast, hundreds of heads opened and materially restricted the spread of the flames.

March 27, St. John, N. B. Emerson & Fisher Bldg. Loss: $450,000.

One man was killed and two others severely injured as a result of this fire which destroyed a large six-story brick-joisted building occupied by wholesale and retail hardware merchants. The interior of the building was of light wooden construction with unprotected floor openings, but the building was protected by a dry-pipe automatic sprinkler system. This system failed to operate because the dry-pipe valve did not trip. The fire was not discovered until it was well advanced, and by the time the fire department arrived the flames had made so much progress that the fire could be fought only from the outside. In about an hour's time the roof and floors began to fall, and shortly thereafter the walls collapsed. Four other buildings were damaged, two frame structures nearly a mile away were fired by flying embers, and a ladder truck was practically destroyed. Had the sprinkler system been in operation, it is probable that the fire would have been at least held in check until the arrival of the fire department, and an alarm would have been sounded much sooner. This fire illustrates the need for regular tests of sprinkler systems. Although the alarm was tested each week, the dry-pipe valve of the system had not been checked since 1938.

April 2, Canton, Mass. Plymouth Rubber Co. Loss: $1,906,000.

This plant was engaged in the manufacture of rubberized fabrics. The building which was destroyed by the fire was a large three-story brick and timber structure. The fire started when friction sparks ignited vapors of gasoline used in rubber curing, and flashed back to the curing machine. Automatic sprinklers within the machine operated promptly, but they were soon shut off by employees, who proceeded to fight the fire with first-aid appliances. After about twenty minutes the fumes from the carbon tetrachloride, which

was used in the curing process to dilute the gasoline, as well as in fighting the fire, became so obnoxious that a call was put in to the fire department requesting gas masks only. The deputy chief who responded to the call summoned the fire department immediately upon his arrival, but by the time it had arrived the fire was beyond control. Many principles of fire protection were violated at this plant. The gasoline used in the curing process was insufficiently diluted with carbon tethrachloride to render it non-flammable; the fire department should have been called promptly; the sprinklers should not have been shut off. At least twenty-three previous fires had occurred at this plant during the preceding twenty-seven years. The direct property loss from this fire was $656,000. The indirect losses have been set at $1,250,000. (July, 1941, QUARTERLY, page 74.)

April 9, Altus, Okla. Traders Cotton Compress. Loss: $261,202.

Fire of undetermined origin swept through one section of a large unsprinklered cotton storage warehouse, destroying or damaging approximately 5000 bales. The outside walls of the building were sheet iron over wood frame, but the whole was divided into seven compartments by concrete fire walls. These fire walls confined the fire to one of the compartments, but this compartment had an area of more than 73,000 square feet. Further subdivision of areas and automatic sprinkler protection would almost certainly have served to reduce the extent of this fire.

April 20, Lakewood, N. J. Conflagration. Loss: $1,000,000.

This fire started in a woodland near Lakewood from an undetermined cause. The woods were tinder-dry following a long period during which no rain had fallen, and it is probable that a carelessly discarded cigarette set fire to the grass and brush. Before the fire was brought under control scores of summer homes, cottages and barns had been consumed. Many structures were engulfed by the brush fire, while others were ignited by flying embers which fell on wood shingle roofs. Estimates place the loss from this fire in the vicinity of $1,000,000.

April 21, Marshfield, Mass. Conflagration. Loss: $1,100,000.

Some four hundred and fifty buildings, mostly summer dwellings, were destroyed in a conflagration which started as a small marsh grass fire. Weather conditions were unusually favorable for a fire. Very little rain had fallen for several weeks and low humidity had prevailed for a considerable period. Fanned by a 30 m.p.h. wind, the fire raced through waist-high grass faster than hose could be laid, and ignited several isolated structures. Embers from these buildings quickly ignited several wood shingle roofs in the congested section of the summer colony, and frame buildings having non-combustible roofs were soon involved through radiated heat. Water supply was reasonably adequate for normal expectancy, but there was lack of hydrants. The area finally burned was approximately 6000 feet long and 1000 feet wide. (July, 1941, QUARTERLY, page 71.)

May 13, Crosby, Miss. Crosby Lumber & Manufacturing Corp. Loss: $413,321.

Fire of unknown origin destroyed a large portion of this plant, including the planing mill, flooring mill and dressed lumber sheds. Nine box cars and two small mercantile buildings of separate ownership were also destroyed. The plant building involved was a single-story frame structure 128,000 square feet in area. There was no public fire protection, but private protection consisted of a watchman, first-aid appliances, standpipe and hose, and outside protection from yard hydrants. There was also a private fire brigade. The fire was discovered shortly after the plant had shut down for the day, and the fire brigade responded promptly. The flames spread so rapidly, however, that the whole structure was involved in less than twenty minutes. Direct property loss has been estimated at $550,000, and in view of the damage to machinery the indirect losses were probably heavy, due to the anticipated difficulty in obtaining replacements.

May 15, Philadelphia, Pa. Wm. H. Lear Lumber Co. Loss: $1,200,000.

This lumber yard occupied a triangular city block of more than four and a half acres. The yard was heavily stocked at the time of the fire, and lumber was piled to a height of thirty feet in some places. More than half of the stock was stored in buildings of frame or iron-clad construction. The fire was discovered during the night, and by the time the alarm was sounded the entire yard was involved. The fire department could do little more than protect the buildings surrounding the yard, many of which were considerably damaged. After the fire a kerosene lantern was found beside the remains of the elderly watchman. It is believed that he suffered a heart attack or shock, and in falling set fire to the building with his lantern. (July, 1941, QUARTERLY, page 78.)

International.

Lakewood, N. J., April 20. Loss $1,000,000.

Wide World.

Marshfield, Mass., April 21. Loss $1,100,000.

Baltimore Sun.

Seldom has the danger of storing large values in congested, inaccessible areas been better illustrated than by this picture. The scene is the William H. Lear Lumber Yard, Philadelphia, Pa., on May 16, 1941. The loss of $900,000 could not have been prevented by any fire department, regardless of its manpower and equipment. Congestion, highly combustible materials, and total lack of fire protection spelled destruction in capital letters.

May 17, Salisbury, Md. Geo. A. Bounds Co. Loss: $282,259.

This plant was engaged in the manufacture of fruit and vegetable crates and baskets. It was destroyed by a fire which started in a large unsprinklered frame shed attached to a sprinklered two-story frame mill building. The fire was discovered shortly after the plant had closed at noon for the week-end. It is believed that the cause may have been a discarded cigarette or sparks from the boiler house stack. The shed where the fire started was full of finished berry baskets in crates awaiting shipment, and the fire spread so rapidly that it was out of control before the fire department could swing into action. There was a high wind which swept the flames toward the sprinklered mill adjoining the shed. The sprinkler system was overwhelmed and the mill destroyed. Hundreds of baskets laid out in the open yard to dry were consumed, and the fire jumped across a street to destroy the firm's unsprinklered brick office building and concrete block boiler house. The fire department, which was aided by several outside volunteer fire companies, had to concentrate its efforts to protecting near-by dwellings. An interesting feature of the fire was the destruction of a wood shingle roof on a dwelling located about a mile distant as the result of flying brands. The loss placed at $282,259 includes direct property loss only.

May 18, Greenville, S. C. J. C. Penney Co. Loss: $500,000.

Fire of undetermined origin destroyed this three-story brick-joisted department store building and three other small mercantiles separated from the Penney property by a narrow alley. When the fire was discovered by police during the night it was well advanced. Despite the efforts of the fire department, the fire spread to near-by property through plain glass windows, and flying brands were responsible for the destruction of a wood shingle roof on a dwelling located three blocks away. One fireman was killed instantly, another

Originating in a pile of lumber lying beside a railroad trestle near by, fire quickly spread to this plant of the Doughnut Corp. of America, Ellicott, Md., on May 27, 1941. Since the plant was located one block outside the city limits, both volunteer and paid fire departments summoned refused to fight the flames until proper authority to do so had been secured. As a consequence, many minutes' delay resulted and the eventual property loss amounted to $1,200,000.

died of injuries, and several were burned or otherwise injured when one of the walls of the department store fell. The loss has been estimated at between $500,000 and $600,000, of which about $200,000 was to the department store stock.

May 21, Portage La Prairie, Man. Airplane Hangar. Loss: $400,000.

This fire occurred in a military hangar and for that reason it has been difficult to secure authoritative information concerning it. Requests to the local authorities were referred to the Department of National Air Service at Ottawa. The N.F.P.A. asked for a report on the fire in line with the usual policy of securing information on all outstanding fires which may provide experience helpful to N.F.P.A. members in taking precautions to prevent similar losses elsewhere. In response to this request, Captain E. C. Farman replied, declining to provide the desired information and making the following comments:

> "The circumstances of this fire were such as are unlikely to arise except at an Air Force establishment, and that notwithstanding the action of fully qualified fire fighters, it is doubtful whether anything could have been done to minimize the effect of the fire or to restrict the destruction that occurred. It is felt, therefore, that no useful lessons could be learned from this accident which would be of value to your members."

From other sources some information has been secured on the fire, which appears not to have any essentially military character, but to be due to the same sort of accidental occurrences and lack of adequate forethought for fire safety which are so often responsible for disastrous fires in civilian properties. The unofficial story is that the fire started when a plane crashed on the roof of a hangar of combustible construction. The hangar lacked automatic sprinklers or any other adequate protection. The water supply was provided by a long dead-end line of 6-inch pipe. Somebody had realized the need for more water and

The principal industry of Lawrenceburg, Indiana, went up in flames when a large part of the Lawrenceburg Roller Mills Co. was destroyed by a fire of unknown origin on May 29, 1941. Attempts by untrained employees to fight the fire in its early stages were unsuccessful. The loss of $350,000 might have been considerably reduced if a trained, private fire brigade had been organized before the disaster.

a fire pump had been installed sometime previously. However, the fire pump was left without connection to the water system and it was of no value when the fire occurred. Other details of the fire protection equipment seem to show similar lack of attention. Wrenches fitted neither hydrants nor hose couplings. A crash fire truck, which otherwise might have been of service, lacked any nozzle for a booster hose stream. Despite these and other handicaps, the city fire department responded promptly and was able to prevent the destruction of another large combustible hangar which was severely exposed.

May 27, Ellicott City, Md. Doughnut Corp. of America. Loss: $1,200,000.

This large plant manufactured doughnut-making machines and in addition stored large quantities of doughnut ingredients, such as flour, shortening, egg powder, etc. The plant consisted of a fire-resistive flour mill, fire-resistive grain elevator, and a fire-resistive boiler house and machine shop. A steel and frame machine shop and warehouses were located on the opposite side of a railroad spur trestle and at the end of this trestle was stored a large pile of crating lumber. It was in this lumber that the fire originated from an undetermined cause. Driven before a 30 m.p.h. wind, it spread rapidly along the wood railroad trestle and was communicated to the frame machine shop building despite the efforts of employees. The plant was located about one block outside the city limits, and when the volunteer fire department responded with two pumpers they refused to fight the fire until authority could be obtained from the chief. It took some fifteen minutes to contact him and get his approval. By this time the machine shop was completely involved and the fire had spread through the windows on the sixth and seventh floors of the mill building. These floors were used for the storage of shortening in drums. The heat caused these drums to burst and the grease and other ingredients were ignited, ultimately transmitting the heat to the lower floors. In the meantime, the Baltimore Fire Department had been called, but it took about an hour to negotiate arrangements by which they could leave the city. However, when they did arrive, they were able to knock the fire down with their heavy streams after three or four hours of work.

Acme.

This unusual view of the waterfront conflagration at Jersey City, N. J., on May 31, 1941, shows the flames at the height of their destructive progress. Cattle pens, an entire grain elevator, mills, docks, and a large fire-resistive warehouse were included in the huge property loss, which eventually ran to $5,000,000. Combustible construction, its inaccessibility to fire fighters, and a delayed alarm were the principal reasons for this disaster.

May 29, Lawrenceburg, Ind. Lawrenceburg Roller Mills Co. Loss: $350,000.

Fire, which started on a wooden railroad spur trestle from an unknown cause, destroyed a large part of this flour mill and elevator, depriving the town of its principal industry. During the early stages of the trestle fire, plant employees attempted to use a private hose line from a hydrant, but the hose burst when the water was turned on. Fanned by a brisk wind, the fire spread very rapidly from the trestle through two open doors in the adjacent warehouse, and was not brought under control and extinguished until it had destroyed or damaged a large portion of the property. Aid was given to the local volunteer fire companies by the fire departments of four near-by communities. The firemen were forced to combat the flames from some distance because of the intense heat and smoke. If there had been a properly trained private fire brigade with adequate equipment, it is probable that the fire would have been extinguished in its early stages.

May 31, Jersey City, N. J. Waterfront Conflagration. Loss: $5,000,000.

This fire resulted in practically complete destruction of 135 cattle pens and the wharf structure upon which they were constructed, an entire grain elevator, a transfer elevator, a feed mill and the pier upon which they were built. Also destroyed was a loading dock, and a fire-resistive warehouse was severely damaged together with its contents. The cause of the fire, which started in the cattle pens, is not known. There appears to have been some delay in sounding the alarm, estimated by city authorities at as much as twenty minutes. Several alarms were finally sounded, bringing in addition to twelve pumpers and other land apparatus two fireboats from New York. The fire spread quickly across a 150-foot slip to the grain elevator. Its spread was aided by burning cattle boats and barges which drifted across the slip to the elevator. Because of these barges and the intensity of the fire, the fireboats were unable to enter the slip during the early stages. One fire boat was hampered by tugs which delayed her entrance into the slip between the elevator and the warehouse. The construction of the stock yards and elevator was such that the fire spread through them rapidly and as they were accessible to the land companies from one narrow shore end only, the fire department was unable to cope with them successfully. The wind carried the smoke and heat to the warehouse building and in spite of the efforts of the fire department and the operation of the automatic sprinkler system, merchandise in the warehouse was ignited. The fire department then concentrated on saving this building. The inability of the sprinkler system to extinguish the fire in the warehouse cannot be regarded as a failure of the equipment. The long continued exposure not only reignited the contents several times, but also caused so many heads to open (estimated at over 600) that the 52,500-gallon tank supply was soon drained and the fire department connections could not supply all the heads which had opened. The large window area in the warehouse was undoubtedly a factor in the passage of heat from the grain elevator fire into the warehouse. The story might have been much different if these windows had been protected by open sprinklers. Damage to the warehouse, while confined to one section of the structure, was nevertheless severe. (July, 1941, QUARTERLY, page 83.)

June 8, Jacksonville, Fla. Clyde Mallory Line Terminal. Loss: $788,000.

Fire of unknown origin completely destroyed two piers, including bulkheads and contents, and caused slight damage to the S.S. *Seminole*. The fire was not discovered until it had made considerable headway in the substructure. The fire department was greatly hampered by the inaccessibility of the fire. As in the case of many other pier and wharf fires, once fire was well under way in the inaccessible, combustible substructure, lacking automatic sprinkler protection, subdivision by fire walls, openings in the deck for fire fighting, or any other form of protection, a heavy loss was to be expected. (July, 1941, QUARTERLY, page 93.)

June 8, Wheeling, W. Va. Wheeling Machine Products Co. Loss: $300,000.

This plant, manufacturing mill and mine supplies and automatic screw machine products, was engaged in filling defense contracts. It was a one, two and three-story building of mixed construction, about 400 feet by 100 feet, and was divided into seven sections by walls with unprotected openings. Stairway openings were also unprotected. The plant was not equipped with automatic sprinklers and the only hydrant available was within twenty feet of the plant. The plant site bordered the Ohio River, but no approaches had been prepared so pumpers could use that inexhaustible water supply in the event of fire. On the afternoon of the day of the fire, the plant was shut down for a general clean-up. Early in the afternoon the watchman discovered fire in the basement. The fire spread rapidly both horizontally and vertically and when the fire department arrived ten minutes later, the

flames were already out of control. Oil-soaked flooring and the contents of a 5000-gallon tank of light oil which fell into the fire and was punctured, added fuel to the flames. Four hose lines were laid from the only accessible hydrant, but one was required almost constantly to keep the other three from burning. The flames were finally checked when they reached a section of the plant constructed of steel. The loss estimate of $300,000 covers the direct property loss only. No estimate can be obtained of the heavy use and occupancy loss.

July 20, Marked Tree, Ark. Chapman & Dewey Lumber Co. Loss: $250,000.

Fire of unknown origin which started in the box factory destroyed, in addition, the flooring mill and adjacent finished stock flooring shed, dry kiln, and sheds, machine shop, generator house and severely damaged the boiler house. Property loss has been estimated at $200,000 and it is believed that large indirect losses, due partly to the difficulty of obtaining new machinery, will bring the total loss to at least $250,000. With the exception of the fire-resistive dry kiln and the semi-fire-resistive boiler house, the buildings at this plant were of single-story wood frame construction. The large box factory and flooring mill building was equipped with a dry-pipe automatic sprinkler system, but not only was the system so old as to be unreliable, but it was poorly maintained and inadequately supplied with water at low pressures. It was to be expected therefore that in view of the large areas, highly combustible construction, and hazardous nature of the occupancy, the sprinklers would be unable to control a fire originating in the factory building. The watchman and plant superintendent discovered the fire simultaneously during the evening. There was apparently some confusion and considerable time elapsed before the mill whistle was blown, sounding the alarm. The plant superintendent attempted to use two telephones, but found them out of order. He was forced to go a quarter of a mile to reach another telephone from which he called the local volunteer fire department. By the time the fire department arrived, the entire main building was involved and the fire had reached such proportions that it was impossible to reach the outside sprinkler control valves to shut them off. Hydrants in the vicinity of the plant were untenable and the fire department had to take suction from a hydrant 1500 feet distant. They were able to protect the lumber yard which was some 200 feet from the plant buildings.

July 24, Chicago, Ill. Elsdon Grain Elevator. Loss: $439,000.

Fire of undetermined origin destroyed a frame iron-clad grain elevator and caused considerable damage to an adjoining elevator of concrete construction. The elevators were remote from water supplies and the fire department, which responded to five alarms, was obliged to relay water from considerable distances. The loss to the contents has been placed at $242,000 and the building loss at $197,000.

July 24, Pembroke, Ont. Consolidated Paper Corp. Loss: $268,000.

This sawmill and lumber yard was swept by fire believed to have been caused by sparks from the boiler stack falling into the sawdust fuel conveyor. There was considerable delay in calling the fire department while the two watchmen and the boiler fireman who discovered the blaze attempted to extinguish it with a private hose line. The mill building was a two-story unprotected frame structure with open stairs and no fire walls. It was seriously involved by the time the fire department arrived. In spite of all efforts to confine the fire, the flames spread to the lumber yard. The property loss has been set at $218,000, to which must be added use and occupancy loss estimated at $50,000.

August 18, Blasdell, N. Y. Exolon Company, Inc. Loss: $1,000,000.

This was an abrasives finishing plant, producing abrasive products vital to national defense. The buildings were mostly of frame construction, steel-clad, one to four stories in height. Floors and roof were of open joist construction and stairs and other floor openings were unprotected. The plant was equipped with a dry-pipe sprinkler system inadequately supplied from the small mains of the village water system. On the night of the fire the plant was in operation. A small fire was discovered in a hollow wooden partition between the first and second floors. It is believed that ignition was due to heat from an oil-fired roaster about four feet from the partition. The sprinklers soon operated and held the fire in check for about fifteen minutes, but they could not extinguish the flames in the hollow partition, and the continued heat opened several more sprinklers farther away. About this time the volunteer fire department took a stream from a private hydrant and later took suction from this hydrant, serving only to reduce the already weak supply to the sprinklers. Outside assistance which was called in also took suction from a private hydrant, further depleting the sprinkler supply. Finally, the Buffalo Fire Department was called and these pumpers, together with one from a local volunteer company, relayed water from large mains and by this means succeeded in saving the company office building and several other

structures. The direct property loss has been estimated at about $575,000 and the use and occupancy loss at between $500,000 and $650,000. Difficulty was anticipated in replacing destroyed machinery. (October, 1941, QUARTERLY, page 168.)

August 18, Brooklyn, N. Y. Waterfront Conflagration. Loss: $1,340,000.

Fire, originating in a quantity of sisal, spread rapidly throughout Pier No. 27 and extended to the freighter *Panuco* and to barges in the slips on both sides of the pier. Finally the fire spread to Pier No. 26 across a 200-foot slip from Pier No. 27. Thirty-four men were killed by drowning or burning and about seventy suffered burns and other injuries. Pier No. 27 shed was one-story high of frame construction and was 725 feet long by 75 feet wide. The pier itself was of heavy wood construction on wood piles. The shed was equipped with standpipe and hose, water pails, and extinguishers. Pier No. 26 shed is of corrugated iron on metal frame construction and is equipped with a good dry-pipe system of automatic sprinklers. Standpipe system and roof monitors are also provided on this pier. The fire started from an unknown cause in a pile of sisal on the pier, having been discharged from the S.S. *Panuco*. It spread rapidly throughout the pier and superstructure and hold of the ship. Upon the arrival of the fire department the fire had already reached the proportions of a five-alarm fire. Within twenty-five minutes of the first alarm practically the entire superstructure of the pier had collapsed. The *Panuco* and barges were almost immediately involved, and Pier No. 26 was soon included in the fire area. Within a short time the superstructure of Pier No. 27 was beyond saving, the *Panuco* had been beached, blazing from stem to stern, seventeen barges and their cargoes had been damaged and the fire department was hard put to keep the fire from spreading throughout the substructure and roof of Pier No. 26. Fireboats and tugs were finally successful in extinguishing the fire in Pier No. 27 and on the barges. The operation of fourteen sprinkler heads on Pier No. 26 aided the fire department in their efforts on this sector, but some difficulty was encountered in extinguishing the fire in the cornice and in the substructure of this pier which were not protected. The fire in the *Panuco* was decidedly stubborn and smouldered for days. (October, 1941, QUARTERLY, page 121.)

August 29, Middletown, Conn. Group Fire. Loss: $306,481.

This fire started in a restaurant and before it was extinguished nine buildings had been gutted. The building housing the restaurant was of brick-joisted construction three stories in height. The other eight buildings were of similar construction varying in height from one to four stories. Most of the buildings were connected, but fire walls and other details of fire protection had been neglected. The fire began when the restaurant chef dropped a pan of burning grease on the kitchen floor. He and the woman proprietor tried for twenty-five minutes to extinguish the fire before summoning the fire department. On duty when the first alarm was received was a total of seven men, six of whom responded with three engines and an aerial ladder. They were joined by volunteers. About a half hour after the first alarm, aid was called from several other cities and towns. The flames spread rapidly to the eight other buildings, and the total area was involved by the time an adequate fire fighting force could get into action. It is obvious that more than six well-trained men are needed to cope with a fire of this size. (October, 1941, QUARTERLY, page 170.)

September 2, Port Costa, Calif. Port Costa Warehouses. Loss: $1,000,000.

Fire of undetermined origin swept through this 2000-foot wharf, destroying in addition, two warehouses, three small vessels, several railroad cars and a large quantity of wheat. The warehouses were used for storage of miscellaneous machinery, bulk grain, and also housed two fish rendering plants manufacturing fish meal and oil. The wharf and warehouses constituted one fire area. The wharf was not bulkheaded and there were no fire walls or other fire stops in the warehouses. When the fire was discovered by the watchman the flames had already burned the telephone wires and he had to go a quarter of a mile to a railroad roundhouse to telephone the alarm. A railroad fire train responded, but was unable to approach closely enough to be effective because the tracks were buckled by the heat and several freight cars were on the siding alongside the warehouses. There was no street leading to the plant and the fire department could not approach the plant with apparatus. Fireboats sent from San Francisco and the Mare Island Navy Yard were unable to make any significant impression on the fire. By the time they were able to travel the thirty miles to Port Costa, most of the wharf had been destroyed and they could not reach the shore side of the warehouses with their fire streams. They experienced some difficulty with floating wheat which repeatedly plugged their condensers and forced them to withdraw. One man, the cook on a barge, was drowned when he jumped overboard to escape the flames. The loss from this fire approximated $1,000,000.

New York Daily News.

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International.

A section of the ruins of the Boston & Maine R. R. freight yards and storage sheds, swept by a five-alarm fire on September 18, 1941. This picture is striking evidence of the fallacy of storing large quantities of goods in buildings of inferior construction, inadequately protected and supervised. Open fire doors and lack of sprinkler and alarm systems made this loss of $1,000,000 almost inevitable. This was Boston's largest fire in thirty years.

September 5, Memphis, Tenn. E. L. Bruce Company, Inc. Loss: $350,000.

Fire of unknown origin occurred shortly before midnight, and due in part to a delayed alarm and large combustible area, totally destroyed the flooring plant of this woodworking establishment. The building destroyed was a single story ordinary frame structure with a concrete floor, having an area of some 77,794 square feet. Block flooring was manufactured at one end of this building while finishing operations and storage occupied the remainder. At about 11:00 P.M. a foreman noticed smoke issuing from a wooden locker. When the locker was forced open, flames and smoke burst out and spread rapidly across the building. Instead of pulling the manual fire alarm box in the building, an employee ran to the boiler house and notified the engineer. The plant alarm was sounded and employees laid two hose streams. At the same time the manual fire alarm box at the boiler house was pulled, summoning the fire department. By the time the fire department arrived, after traveling the two miles to the plant, the entire building was involved and beyond saving. Efforts were directed toward protecting the lumber yard located some forty feet away. It is believed that if the alarm had been sounded promptly from the building where the fire occurred, the fire department might have been able to have effectively stopped the fire at the locker. This was the second unsprinklered frame building at this plant which had grown to excessively large area and then subsequently been destroyed by fire with heavy loss. Located just outside the city limits, the plant was subject to no legal restrictions on size.

September 10, Chicago, Ill. Universal Carloading & Distributing Co. Loss: $550,000.

Fire of unknown origin swept through a block-square four-story freight warehouse in the downtown section of the city. The building had brick walls, laminated and joisted floors, no sprinklers, large unprotected elevator shafts, and was divided into three sections by fire walls with openings protected by double automatic fire doors. The fire originated on the first floor. By the time the fire department arrived the entire floor was involved and flames were leaping across a forty-five foot street against large fire-resistive office buildings. The fire department managed to keep the fire out of these buildings, although the window glass

was cracked from heat up to the seventh floor. Because of the combustible nature of the contents and the draft conditions afforded by the unprotected vertical openings and open windows and doors, the fire spread rapidly throughout the building. The fire doors to the adjoining sections were ineffective, as they were blocked open by merchandise and in some cases by steel plates across the threshold. In addition to the loss to the building and contents, thirty-five truck trailers, many of them loaded, were reported burned at the loading platform. Loss to the contents, representing about 25 per cent of capacity, was estimated at $150,000. Building loss was estimated at $400,000.

September 18, Charlestown (Boston), Mass. Warehouse Conflagration. Loss: $2,000,000.

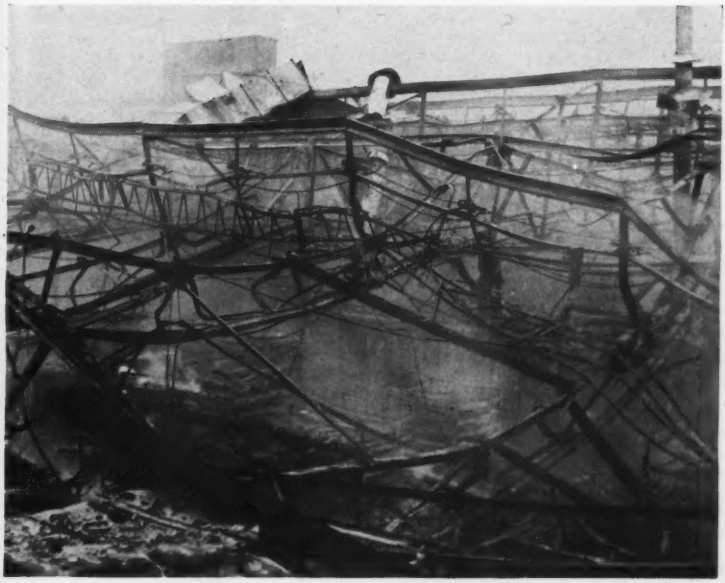
The buildings involved in this fire were four one-story frame freight houses, each of which was about 620 feet long by 100 feet wide, set on posts four feet above the ground. The open spaces under the buildings were enclosed with wire mesh, but there were no fire divisions of the substructure area. There were eight transverse metal-clad fire partitions in the shed where the fire originated, dividing the area into nine sections. Each partition had two openings with metal-clad doors hung on wood frames, but few, if any, of these doors were closed at the time of the fire. All the buildings involved were equipped with first-aid appliances. The buildings were used principally for the storage of canned foodstuffs, but there was also some storage of building supplies and other materials. The fire started shortly before 6:00 P.M. in Freight House No. 35. In response to a telephone alarm the fire department responded with a pumper, a ladder truck, and a District Chief. By the time the firemen were able to get water on the fire, the entire area was involved. A box alarm was quickly followed by third, fourth and fifth alarms and then a call for all available Boston apparatus. The fire was so intense that it was impossible to take a stand between any of the freight sheds, all four of which were by now involved. A stand was taken, however, from the adjacent fire-resistive fruit terminal building. Further spread of the fire was stopped except for several minor roof fires set by flying brands and severe damage to a frame building 1400 feet distant which was ignited by flying brands. This fire illustrates the fallacy of storing large volumes of goods in inferior structures closely grouped and without sprinkler protection or automatic fire alarm. Had the fire doors been closed, the fire probably would have been confined to the section where it originated. The delayed discovery and the inadequate response to the telephone alarm were also significant factors in the spread of the fire. (October, 1941, QUARTERLY, page 153.)

September 23, East Gulf, W. Va. C. H. Mead Coal Co. Loss: $466,000.

Fire of undetermined origin destroyed the coal tipple, conveyor, head house and sections of conveyor belts from two coal mines. The fire broke out during the afternoon in the tipple where welding operations had been carried on a short time previously. Due to the flammable construction and crowded and dusty condition of the tipple, the fire spread rapidly and was soon beyond control of the first-aid appliances which were used. There were no fire protection facilities other than first-aid appliances at the plant, but the fire department from a town eight miles distant responded to a telephone call and managed to save some buildings and keep the fire out of the mines. The property loss was placed at $155,000, but indirect losses exceeded $300,000.

September 30, Cleveland, O. National Bronze & Aluminum Foundry. Loss: $1,000,000 or more.

Fire, attributed to spontaneous ignition of oily aluminum chips and turnings, destroyed the large unsprinklered foundry building of this plant which is engaged in vitally important defense production of rough aluminum castings. The plant was mostly single-story steel frame structure with corrugated steel siding. Roof construction was largely plank on steel frame. A one-story brick-joist office building adjoined the foundry, being cut off by a fire wall having unprotected openings. When the fire was noticed in a corner of the foundry, employees attempted unsuccessfully to extinguish it with two soda-acid extinguishers. The fire spread rapidly through the oily aluminum scrap and the burlap bags in which it was stored, filling that part of the plant with dense black smoke. Employees were apparently unable to locate the manually operated central station fire alarm boxes with which the plant was equipped and an alarm was telephoned to the fire department. Before the arrival of the first two engine companies, the fire had spread to a large portion of the plank and timber roof. Upon the arrival of the first apparatus, a third alarm was immediately ordered, followed shortly by a fifth alarm, and still another call for apparatus was soon sounded. A 25 m.p.h. wind carried the fire across the plant, which was practically destroyed in an hour and a half. Property loss estimates have varied from $1,000,000 to $2,250.000, in addition to which there was a large use and occupancy loss. (October, 1941, QUARTERLY, page 163.)



Acme.

Fire in the plant of the National Bronze and Aluminum Foundry Company, Cleveland, on September 30, 1941, caused an estimated damage of $1,000,000 or more, destroying parts in process for airplanes and tanks, together with machinery of vital importance to wartime production. Lack of sprinkler protection and proper fire walls made the efforts of a large and efficient city fire department almost useless.

October 9, Chester, Pa. Penn Steel Castings Co. Loss: $300,000.

This plant specialized in heavy steel castings and was engaged in defense production when fire severely damaged the main building. This building was a one and two-story brick structure with an unprotected steel truss roof and having an unbroken area of 164,000 square feet. The cause of the fire was the breakage of a pair of fuel oil and compressed air lines to the ovens, creating a blowtorch effect. The plank roof and steel trusses and craneways were quickly destroyed. Water supplies were poor and most of the water was taken by the fire department from feed mains three blocks away. A few lines were also taken from the Delaware River, but this was difficult because of lack of approaches to the river and low tide. Damage to the plant has been estimated at 40% of the main building, and also there was damage to craneways, five electric cranes, annealing furnaces, core ovens and incidental machinery.

October 11, Fall River, Mass. Firestone Rubber & Latex Products Co. Loss: $11,000,000.

Fire originating in an unsprinklered oven used for drying foam latex cushions resulted in the largest single industrial fire loss in the United States on record. (For full report of this fire, see page 249.)

October 26, Portland, Me. Southworth Machine Co. Loss: $267,462.

This plant was engaged in the manufacture of airplane propeller parts for national defense needs and was operating both day and night. The property involved was a single-story L-shaped brick building with plank and timber floors and wood-joisted roof. The arm of building in which finishing processes were carried on was cut off from the main machine shop section by a fire wall with automatic fire doors at the openings. The fire started from an unknown cause shortly after 1:00 A.M. in the stockroom located in a corner of the main section. Watchmen and employees fought the fire unsuccessfully with

extinguishers until it was beyond control. It is claimed that an attempt was made to telephone an alarm, but the wires were burned. This has not been substantiated, however. Certain it is that outsiders saw the fire from a distance of about 1500 feet and turned in the alarm from a box which they were near. The responding apparatus was misdirected to another plant some distance away and this resulted in a serious loss of time. By the time the fire department arrived at the scene, practically the entire first floor area of the main section was involved. For some reason the fusible links on the fire doors protecting the finishing section failed to operate and the doors were pushed shut by firemen. By this act, the finishing section was saved from serious damage. When the fire was extinguished, the roof had been completely burned from the main section. Although the floor remained, the machines were ruined and additional machinery in the basement was damaged by water. The loss has been placed at $267,462, of which more than $100,000 was for loss of use and occupancy. It is an interesting commentary that a sprinkler system had been on order for this plant for several weeks.

November 13, Tucson, Ariz. F. W. Woolworth Co. Loss: $250,000.

Fire which started in the basement of this department store gutted the two-story brick-joisted building, destroying a large Christmas stock of merchandise. The fire was discovered by the janitor when he reported for work in the morning. The fire department responded promptly but were hampered in their efforts to reach the seat of the fire by dense smoke and frame enclosures and stock bins which had been erected in the basement. The fire continued to spread through the basement and up the frame stair enclosure, and finally part of the first floor collapsed, allowing the flames to gain a new advantage. The fire spread from the second floor through hollow false columns to the roof. About seven hours after the start of the fire an explosion occurred at one corner of the roof space, blowing out part of the parapet wall. Not long after this, the second floor and roof collapsed. The fire was brought under control about ten hours after it was discovered, but was not extinguished until the following morning. This fire emphasizes the need of automatic sprinklers in the basement. It also demonstrates the importance of firestopping in hollow construction.

November 17, Lansdale, Pa. Andale Engineering Co. Loss: $250,000.

This plant manufactures special pipe and valve fitttings, condenser units and separators, largely employed in work for the U. S. Navy. It consists of two shops, well separated, only one of which was involved in the fire. This building was one story high, with an area of 10,000 square feet. It was constructed of unprotected steel framework, with curtain walls of 70% glass and steel frames. Machine work on steel castings and assembly details were carried on in this building. Fire started in the small blueprint room before the close of the day's work and spread through the plank roof structure. In the absence of any private fire protection, a local volunteer fire company, although well equipped, was handicapped by an insufficient water supply. Several other volunteer companies responded from near-by communities, but were delayed by long hose lays to remote hydrants and limited water supply. The fire was confined to the building of origin, but the intense heat caused the main columns to buckle, which distorted the entire steel framework and the building was practically a total loss. The loss to bar machine tool stock, machinery and fittings was considerable. At the time the fire occurred, the company was negotiating for a water main adequate to supply fire fighting needs.

November 22, Spartanburg, S. C. Haynes Bonded Warehouse. Loss: $487,000.

Fire of undetermined origin completely destroyed four cotton warehouses together with their contents, consisting of 5186 bales. The property was located about three-quarters of a mile beyond the Spartanburg city limits. Warehouse No. 1 where the fire started was a single-story structure of metal-clad wood frame ordinary joisted construction with composition covered roof and a wood floor. Warehouses Nos. 2 and 3 of frame construction were detached 40 feet from No. 1, and Warehouse No. 4 was detached 50 feet from Nos. 2 and 3. The buildings were protected by three automatic dry-pipe sprinkler systems, all three of which were supplied by a single connection to an 8-inch dead-end main. The operator of a near-by fruit stand discovered the fire when water-motor sprinkler-alarm was heard and smoke was seen issuing from the eaves of Warehouse No. 1. The Spartanburg Fire Department was notified by telephone and arrived at the plant about fifteen minutes after discovery of the fire. By this time it had reached considerable intensity and the fire department was of little or no service, as the nearest hydrant was over 3000 feet from the property. Water supply for the sprinklers was weak and this, together with the obstruction from the high-tiered cotton, accounts for the failure of the sprinklers to control the fire. When it

was realized that the fire was beyond control of the sprinklers in the building of origin, an unsuccessful attempt was made to shut them off. Without sufficient water, automatic eave sprinklers on the exposed wall of the building housing Warehouses Nos. 2 and 3 were of no value when this wall caught fire from radiated heat about thirty minutes after arrival of the fire department. Due to the frame walls this building burned with greater intensity than Warehouse No. 1 and after about an hour Warehouse No. 4 started burning. Fire at Warehouse No. 4 was unchecked, the water supply to sprinklers being completely wasted through broken sprinkler piping at Warehouse No. 1. Just as this last building was engulfed in flames, it began to rain heavily. That the fire did not continue to spread to another exposed warehouse is attributed to the rain and a shift in the wind.

November 24, Seward, Alaska. Conflagration. Loss: $500,000.

Thirteen buildings were totally destroyed and five or six others in the business district were damaged by a fire which started in a barber shop. The barber reported that when he attempted to light his oil stove, oil which he had spilled on the floor was ignited. Some four hundred persons were made homeless as a result of this fire which swept through the frame buildings before a 30 m.p.h. wind. The barber shop fire was believed under control after the volunteer fire department had worked for about a half hour, but the wind whipped the flames into sudden fury and the entire building was again engulfed. Reports indicate that the water supply was inadequate and suction had to be taken from the bay. Soldiers called out to aid the firemen and townspeople formed bucket brigades and used dynamite in efforts to check the flames.

December 7, Lawrence, Mass. Multiple Occupancy. Loss: $275,000.

The five-story Odd Fellows Building in the center of the city was destroyed by a fire which started in a candy and bakery kitchen on the second floor. The fire is believed to have originated in a metal duct for carrying fumes and grease away from the baking ovens. The building was of brick construction with plank and timber floors. The fire spread rapidly through the ceilings and partitions and spread to the adjoining six-story office building, destroying the roof and gutting the top floor. This fire illustrated the danger of relying on over-age fire apparatus. During the course of the fire three ancient pumpers went out of service and a twenty-one-year-old aerial ladder broke. Only the fact that much outside aid was secured from surrounding cities made it possible to combat this fire.

December 10, Monmouth, Ill. Western Stoneware Co. Loss: $300,000.

Fire, caused by the rupture of an oil line supplying kilns, practically destroyed four buildings and damaged three others with a loss estimated at $300,000. The plant manufactures pottery and stoneware. Buildings were of ordinary brick and frame iron-clad construction. First aid protection was inadequate in the building where the fire originated, but was adequate elsewhere. Fire started during the afternoon while the plant was in full operation. An oil line ruptured, spraying hot oil on the firing section of a kiln and on the walls, floor and roof of the building. The break was noticed at once by an employee who shut off the oil pump, but by this time the oil had ignited. The fire department was summoned and employees meanwhile attempted unsuccessfully to control the fire with a private 2½-inch hose line. When the fire department arrived, the flames were bursting through the roof of the building and an adjacent building was also involved. Driven before a strong wind the fire continued to spread in spite of the efforts of the firemen. The light construction and large unbroken areas of three of the buildings and the presence of large frame roof monitors, together with the strong wind, were contributing factors to the rapid spread of the fire.

December 14, Edgewater, N. J. Spencer Kellogg & Sons, Inc. Loss: $350,000.

A hydrogen explosion, cause unknown, seriously damaged this chemical plant and other property near by. One man was killed by the explosion, which occurred in a section of the building where hydrogen was generated and compressed. The floors and walls of the fire-resistive reinforced concrete building were damaged by the blast, a garage near by was practically demolished, and other structures were damaged. Many homes and stores were shaken and shattered windows were common. Preliminary estimates have placed the property loss at $350,000, in addition to which large use and occupancy loss is probable.

December 16, Sackville, N. B. Mount Allison University. Loss: $300,000.

At least four men students lost their lives and several others were burned and injured by a fire which destroyed a dormitory. Cause of the fire has not been determined. The dormitory was a four-story stone building with wooden interior construction. About two

hundred students were in the building when the fire was discovered about 2:00 A.M. The fire spread rapidly through the building by way of an unprotected elevator shaft. Students attempted to check the flames with private hose streams, but were unsuccessful. The fire department responded promptly, but by the time they arrived the fire was beyond control.

Factors Responsible for Large Losses.

Following is an analysis of the factors responsible for the large losses. In every fire, several factors contributed to the rapid spread of the flames and the excessive loss.

Reasons for Large Losses.

	No. Times Contributing
Structural Factors	
Inferior construction, excessive areas, etc.	39
Lack of sufficient exposure protection	23
Unprotected vertical openings	19
Occupancy Factors	
Highly flammable contents, excessive amounts of burnable stock	23
Flammable liquids and gases	14
Unsafe heating equipment	4
Contents of unusually high value	5
Fire Protection	
Lack of adequate private protection	28
Lack of fire doors or cut-offs between sections	23
Fire doors blocked open or otherwise inoperative	2
Lack of adequate public protection	6
Sprinkler system shut off	2
Failure of sprinkler system dry valve	1
Fire Fighting	
Fire difficult of access	10
Poor fire fighting by employees	5
Fire department inadequately manned or equipped	6
Inexperience in fighting fires of such magnitude	7
Fire department delayed	3
Delays in Giving Alarm	
Headway of fire when discovered	14
Efforts made to extinguish without giving alarm	6
Watchman became confused	3
Lack of public fire alarm system	2
Telephone out of order	4
Water Supplies	
Inadequate water supply	14
Shortage of hydrants	8
Lack of approaches to river water supply	2
Weather Conditions	
Strong wind	11
Low humidity	3
Explosions	4

Honolulu Air Raid Fires.

By W. W. Blaisdell,
Chief Engineer, Honolulu Fire Department (Member N.F.P.A.).

Immediately after the Japanese air raid on Hawaii on December seventh, General Manager Bugbee wrote to Chief Blaisdell asking about the activities of the Honolulu Fire Department during the raid. The following is Chief Blaisdell's letter, dated December 20, 1941.

Surprise was the word for it. While certain plans to be followed in the event of an attack on this city had been made, more were in a formulative condition.

We have eight engine companies in Honolulu proper, each consisting of a combination pumping engine and combination hose wagon, housed in seven stations, and one aerial ladder truck.

Within half an hour after the first attack, all off-duty firemen were called in by radio broadcasts from three stations, and all but a few who live in rural Oahu had reported within two hours.

Scores of volunteers thronged the stations, and workmen from other city departments were assigned as emergency firemen.

Thus it was possible to use each of our units as a company. In addition to this, nine commercial trucks were commandeered; each was loaded with 1200 feet of 2½-in. hose and placed in strategic locations, each in charge of a trained fireman, whose position was filled by a volunteer. This was also done with our one reserve pumper and a Reo truck with booster equipment.

During the 72-hour period following the first attack, one unit only was dispatched on each alarm. Boxes which came in were not transmitted, all assignments being made by telephone.

During the height of the attack, no effort was made to mop up, it being felt that, immediately after a fire had been extinguished enough to prevent its spread, apparatus should be returned to quarters in readiness for other fires.

As near as we of the Fire Department can tell, there were no incendiary (Thermite) bombs dropped, all of them being demolition.

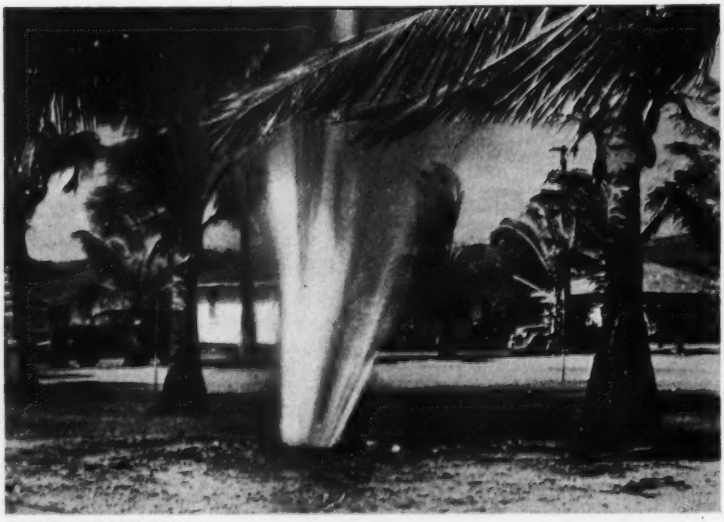
Necessarily, our efforts were directed toward the best protection possible for the high value district and the waterfront.

Three of our companies had been sent to Hickam Field, where fires had been started in hangars, barracks and planes on the landing field. Hickam's apparatus had been put out of service by bombs.

The men of these three companies stayed with their lines amid a hail of machine gun bullets from raiding planes and shrapnel from large demolition bombs. The hydrants were rendered useless when the main was broken by a

International.

A part of the ruins of the thirteen Japanese-owned houses destroyed in the group fire started by bombs. This fire was brought under control by one hose company.



Pathé News—Life Magazine.

Bombed water mains reduce the pressure available for fire fighting and necessitate pumping through long lines of hose. Water mains in this comfortable climate are not very deep, but previous experience in London shows that mains as much as thirty feet underground can be cracked by high explosive bombs.

Pathé News—Life Magazine.

Wooden shingle roofs predominate in the residential sections of Honolulu. This picture shows sparks and embers driven by the brisk wind starting fires on near-by roofs.

bomb and our three pumpers drew water from the bomb crater, pumping through 6400 feet of 3-in. and 2½-in. hose, the last apparatus returning to the city at midnight.

Each piece of apparatus bears holes from bomb fragments and bullets. One pumper was put out of commission when machine gun fire demolished the ignition switch, and had to be towed back. One hose wagon was set on fire, presumably by an incendiary bullet, which pierced the gasoline tank. The motor, however, was not badly damaged and this piece will be put back into service soon, as repairs are being rushed on the body. The engine was put back in commission the same afternoon.

Our greatest loss and the one most keenly felt was that of two captains, one with 34 years' service and the other with 23½ years, and a hoseman who had been in the department a little over three years. These men were killed by machine gun bullets from dive bombers and may God hasten the day when those treacherous Japs shall pay for this. Six other firemen were injured, one a lieutenant; one has returned to duty and the five are still in the hospital, recuperating from wounds in various parts of their bodies.

On December 7th we answered 39 alarms. Not all were caused by bombs, and not all the bombs that hit buildings started fires.

The largest one, in the semi-residential district, involved 13 buildings before it was brought under control with one hose wagon manned by a captain and six hosemen. This loss will approximate $165,000.00.

The engine which ordinarily responds with this hose wagon confined another fire to the building of origin, scorching the walls and roofs of the two houses on either side.

Pathé News—Life Magazine.

The Lualliai School was ignited on its combustible roof by embers carried by the wind from the group fire pictured on page 222. Men on the roof dimly outlined through the smoke are fighting the falling embers. First-aid equipment may be seen in the foreground.

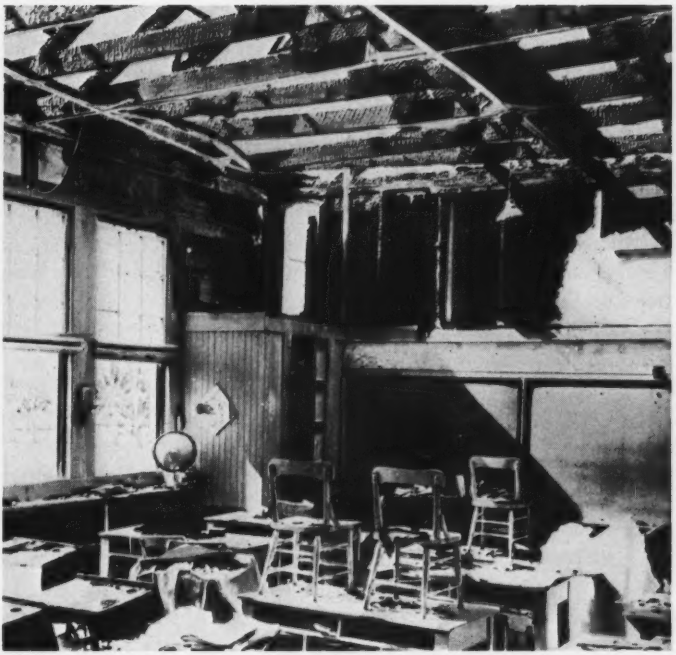
Simultaneously with the above-mentioned two fires, which were only a block apart and both started by bombs from the same plane, a large two-story wooden frame school, built in the shape of a U, caught fire, probably from sparks from one or both of the other two fires. Meanwhile a high wind had arisen, which prevented our streams from doing very effective work. Nevertheless this building was saved by the crews from the engine above mentioned, the lieutenant in charge having left two men at the dwelling fire using hydrant pressure and moving in on this fire in conjunction with another engine which had been dispatched. Using four 2½-in. lines they confined this fire to the second floor and roof of the bottom of the U.

We have recently purchased seven Chevrolet trucks without body, which our shop is rapidly converting into hose wagons.

In the event of another air raid, we have made arrangements for nine other trucks and drivers to report at designated points, together with sufficient volunteers to man them.

Our fire wardens (civilian volunteers) are constantly instructing our people how to handle incendiary bombs and continually warning them of the not remote possibility of other attacks.

As for advice to Fire Chiefs in other cities, I can only say this. Prepare for the worst and insist on getting enough equipment *on hand* to handle the biggest fire they can imagine, in the most hazardous district in their cities.



International.

Interior of the school after the fire. The top was burned off, but despite numerous handicaps the fire department was able to extinguish the fire before it had consumed the entire building.

This is interesting. A check-up of the occupants of the 13 buildings involved in one fire disclosed the fact that every occupant with but one exception was Japanese and that all of the buildings but two were owned by Japanese.

Also, as far as we have investigated, no fire insurance policy issued on any building struck by bomb with a subsequent fire will pay any loss from the fire resulting either directly or indirectly. Rather ironic in this case, don't you think?

I'm sorry this letter is not more coherent, but I'm sure you realize the difficulties under which it is written. It is anything but pleasant to be blacked out each night, to have the use of headlights and sirens barred and the speed at night restricted to 20 miles per hour. And the constant fear of more bombing, with practice air raid warnings and the realization that our country is at war, is far from comforting. However, you may be sure that the Honolulu Fire Department will always be there, always giving its best and, with God's help, always winning.

Pitch for Extinguishing Magnesium Fires.

By Hylton R. Brown and Irving Hartmann.

Large quantities of magnesium are being used in airplanes and munition plants where fires may vitally affect our war activities. In the present emergency it may also become necessary to provide in private homes as well as in all other types of structures some form of protection against the magnesium type of incendiary bomb. The hazards and difficulties experienced in attempting to extinguish magnesium fires and incendiary bombs have been called to the attention of readers in recent articles, and special efforts have been made by organizations and individuals to develop a satisfactory extinguishing agent for such fires.

As has been pointed out in previous articles, the use of water on magnesium fires causes a violent reaction when it comes in contact with the burning metal, and virtually all of the other recognized types of fire extinguishers either are ineffective or intensify magnesium fires. Special attention has been given to the development of powders capable of forming an incombustible blanket or covering for the fire. Sand, borax, portland cement, powdered limestone, talc, graphite, powdered shale, cast-iron borings, brass turnings, shredded asbestos, ashes, and salt have been tried. Although many of these materials can be used effectively as a cover, owing to the high temperature of a magnesium fire it continues to burn if oxygen reaches it through the cover, or from below, or by dissociation from the covering material. If moisture is present in the covering material, numerous small explosions may occur, which will scatter burning material outside the original fire zone. The abrasive or corrosive action of many of the materials mentioned makes their use objectionable in machine shops or factories where there is possibility of damaging bearings or fine equipment.

Pitch as an Extinguishing Agent — Its Action and Characteristics.

In undertaking a study of suggested methods of extinguishing magnesium fires the authors realized that the material being sought as an extinguishing agent should be nonabrasive, noncorrosive, nonflammable, nontoxic, and capable of extinguishing fires of a size that ordinarily would be expected in plants producing the readily flammable magnesium turnings, shavings, and powder. Also it should be cheap, readily available, and easily applied. With these objectives, a series of tests was started at the Bureau of Mines laboratories which resulted in the discovery that, although it did not meet all of the specifications mentioned above, hard coal-tar pitch in granulated or flake form

This article, published by permission of the Director, Bureau of Mines, U. S. Department of the Interior, is a contribution from the Central Experiment Station, Pittsburgh. Mr. Brown, Senior Engineer, is Secretary of the N.F.P.A. Committee on Dust Explosion Hazards. Dr. Hartmann is Physicist, Bureau of Mines.

was effective in extinguishing most types of magnesium fires and small magnesium incendiary bombs. Coal-tar pitch is the residue from the distillation of coal-tar and was first considered for use on magnesium fires because of its sealing action. It was realized that to extinguish a magnesium fire effectively all possible sources of oxygen must be shut off completely. When applied to a magnesium fire pitch softens rapidly and forms an effective seal that excludes the air.

Pitch has the advantage of being readily available or easily obtainable at low cost and is nonabrasive, which makes it particularly suitable for use in machine shops. It can be applied easily by scoops or shovels, and after the fire is extinguished and the pitch has cooled it can be removed from a pile of magnesium chips or shavings as a shell and peeled or chipped from solid surfaces. Certain types of pitch appear to be more suitable than others for use on magnesium fires, and both the form in which the pitch is used and the method of applying it are important. The procedure developed in a large number of tests with pitch on magnesium fires and incendiary bombs at the Bureau of Mines and elsewhere is described briefly below.

The properties of coal-tar pitch depend chiefly on the character of the tar distilled and on the final temperature of distillation. As the distillation temperature is raised the pitch produced is harder, the softening temperature is higher, and the volatile matter content is lower. Pitches are produced in a number of different grades, but may be classified roughly as soft, medium or hard, depending on their softening temperature. Magnesium burns at a high temperature, and the pitch most effective on this type of fire is very hard, with a softening temperature of approximately 300° F. It is recommended that only pitch of this grade be used on magnesium fires. This pitch usually is described as "hard coal-tar pitch suitable for pulverizing," and sometimes is used in pulverized form as fuel in steam-generating power plants. Hard water-gas-tar pitch and hard petroleum pitch or petroleum asphalt with high softening point also may be used to extinguish magnesium fires under certain conditions.

Hard coal-tar pitch usually is marketed by the producers in flake or roughly crushed form. This type of pitch in flake or granulated form will not burn readily unless the air around it is in motion so that enough oxygen reaches it. Pitch in granulated form—through 6- and on 35-mesh—and in flakes about 1/16 inch thick and ⅛ to 1 inch wide has been used successfully to extinguish magnesium fires in tests and demonstrations. As finely divided pitch in pulverized or powdered form is flammable and capable of forming explosive mixtures with air, it is important that the pitch used as an extinguisher for magnesium fires be coarse enough to eliminate this hazard. It is recommended that no pitch finer than 35-mesh be provided for fire extinguishing purposes. If pitch is used in the flake form supplied by the producers it should be screened to remove the dust or fine powder.

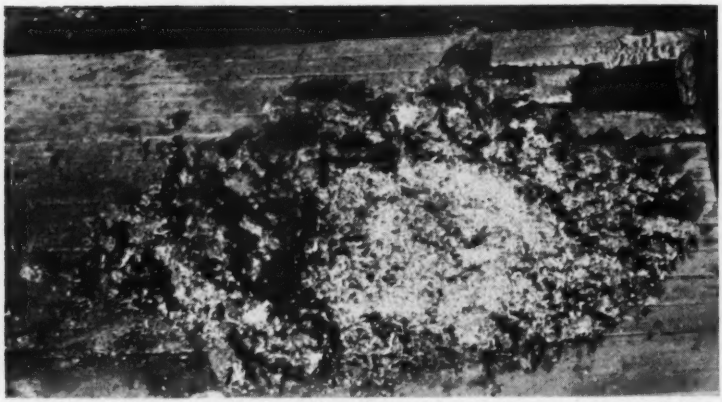


Fig. 1. Unburned magnesium chips after pitch covering was removed following extinguishment of fire on wood floor. (The hole in the corner of the floor was burned in a previous test, before the tests with pitch.)

Use of Pitch on Industrial Plant Fires.

Tests and demonstrations have been made with pitch on many different types of magnesium fires and an attempt made to reproduce as closely as possible the type of fire that would likely occur around lathes, milling machines, or similar equipment in metal working plants. Fires have been started in piles of magnesium shavings, turnings, broken castings, chips, and powder. The material has been arranged in piles of 1 to 6 pounds, as it would accumulate around the machines. The extinguishing tests were made on different types of surfaces, such as wet and dry ground, wet and dry concrete, metal, and wood. From the results of these tests it has been possible to develop a method of applying hard coal-tar pitch on plant-type fires that, it is believed, will be effective in most instances.

When the fire is on dry ground, concrete, or metal surfaces, or in metal pans or containers, the procedure is simply to cover carefully the entire surface of the fire with pitch and allow the pitch to melt and seal the fire. It is advisable to apply the pitch initially with long handled scoops or shovels to avoid getting too close to the fire. The pitch should be spread over the surface of the fire carefully and deliberately. It should never be thrown on the fire, and it should not be mixed into the burning mass. After the initial application with long-handled shovels has reduced the glare and heat, small hand scoops can be used to apply pitch to uncovered portions of the burning mass. Immediately after application of the first thin layer of pitch, small yellow flames may be noticed on the surface, but these will be extinguished as the sealing action proceeds, or may be quickly smothered under another layer of pitch. After the fire is extinguished, the hot mass should be allowed to cool for a

Bureau of Mines.

Fig. 2. Civilian Defense Committee demonstrating application of granulated hard coal-tar pitch on magnesium incendiary test bomb. The success of this method depends upon using pitch of the proper grade, screened to remove fine particles.

short time before an attempt is made to remove the pitch. The pitch can be removed most readily after it has cooled but before it solidifies enough to become brittle.

When the fire is on a wood floor or wet ground, the extinguishing procedure to be followed is slightly different. A small amount of pitch should be applied over the fire to reduce the heat and glare. A layer of pitch about one inch thick can then be spread alongside the fire and the burning mass carefully transferred onto this layer of pitch with a shovel or hoe. Finally the entire surface of the fire is covered with pitch as previously described and the mass allowed to cool. Fig. 1 shows the unburned magnesium chips, which remained under the pitch layer after a fire in 6 pounds of this material placed on a ¾ inch board floor had been extinguished by the method described.

Magnesium powder is highly explosive and ignites readily when suspended in air. For this reason extreme care must be exercised to avoid the formation of dust clouds by mixing or disturbing fires in magnesium powder or fires in locations where accumulations of magnesium dust or powder may be thrown into suspension.

Use of Pitch on Incendiary Bombs.

The results originally obtained with hard coal-tar pitch as an extinguishing agent for magnesium fires in industrial plants were so encouraging that the testing program was extended to include the magnesium type of incendiary

Bureau of Mines.

Fig. 3. Final sealing and extinguishment of incendiary bomb.

bomb. The bombs used in this series of tests were made to resemble or to reproduce the effects obtained with the electron bombs that have been droppd on London. Some of the test bombs were made of heavy magnesium tubes, 6 inches long and 2 inches in diameter, with the ¾ inch inside diameter space packed with thermit. Others were simulated bag or tube bombs made by packing pieces and shavings of magnesium and a quantity of thermit in paper, cardboard, or light metal containers.

These bombs were ignited and allowed to burn until the thermit reaction was finished, as in this reaction the thermit supplies its own oxygen and no extinguisher would be effective. After the magnesium part of the bomb was ignited by the heat of the burning thermit, pitch was applied and observations made to determine its extinguishing possibilities. The results were satisfactory and indicate that incendiary bombs of the magnesium type can be extinguished with hard coal-tar pitch. In a number of instances the unburned portion of the bomb recovered after extinguishing tests with pitch amounted to approximately half of the original bomb.

The procedure to be followed in using pitch on incendiary bombs is similar to that recommended for magnesium fires in factories. If the burning bomb is on an incombustible, dry surface it is only necessary to cover it with pitch and allow the mass to cool. Long handled scoops or shovels are required for proper application of pitch on incendiaries, as the reaction within the bomb usually throws burning pieces of metal for some distance and the extreme heat

makes close approach impractical. When the bomb is on a wood floor it is necessary first to spread a layer of pitch near by and then roll or push the bomb onto it. The bomb is then covered with pitch to seal the burning surfaces completely and extinguish the fire. Figs. 2 and 3 show members of a civilian defense committee applying granulated hard coal-tar pitch on an incendiary bomb, and the final sealing and extinguishment being accomplished by application of additional pitch from a hand scoop.

Additional Information Available on Tests.

A more complete description of the tests cited in this article, with information on sources from which pitch can be obtained, the approximate cost of the material, recommendations covering the preparation of pitch and its application on different types of magnesium fires, and suggestions for protection of buildings and equipment has been prepared by the authors as a publication of the Federal Bureau of Mines.

Incendiary Bomb Structural Protection.

By S. H. Ingberg (Member N.F.P.A.),
National Bureau of Standards.

The hazard from all types of incendiary bombs can be decreased by applying some form of incombustible covering over the attic or upper floor, assuming that this will act as a stopping layer for at least some of the bombs that may be used. While without defining type and weight nothing definite can be said relative to the penetration of these bombs, even the lighter ones would be expected to go through an ordinary wood frame roof with the usual roof coverings and possibly also an attic or upper floor.

The covering applied to such floors would increase the resistance to penetration, as well as affording protection against ignition by the bomb. The thickness to be applied need be limited only by practical considerations of cost and the weight that the construction can support. There will be progressive gain in safety with increase in thickness. A 1 to 1½-inch thickness of portland cement mortar or concrete, cast-in-place or as precast slabs, will prevent ignition of a wood floor from a bomb such as one of the kilogram thermite-magnesium type. Lesser thicknesses would give temporary protection and the incombustible finish would assist materially in effecting extinguishment or removal of the bomb without ignition of the floor beneath.

Slabs made with cinders, slag, and other lightweight aggregates are somewhat more resistive than those made with sand and gravel, although the latter do not disintegrate appreciably under the heat of the bomb. Precast slabs may require a finish consisting of portland cement mortar or magnesite to give an even wearing surface. The wearing properties of portland cement mortar can be greatly increased by the addition of emulsified asphalt in the mix. The precast slabs should preferably have beveled edges to enable the mortar to fill the

joints fully, and can be nailed in place through such joints. An alternative to nailing might be to bed them in mortar. Where the traffic is light and surfaces are fairly even, it might serve the purpose to fill the joints with mortar and apply a rubber-base concrete paint in lieu of other top finish.

Slabs of burnt clay might also be applied for the purpose and there appears to be a field of development here for the concrete and clay products industries. Present stock sizes in solid or near solid units of thickness from 2 inches up might be used if other considerations permit.

Where the ceiling construction has no floor above, the most practical method would probably be to floor it over with boards, that need not be matched, and then apply coverings such as those indicated above, assuming the framing can support the added weight.

Ignition of the wood floor is, of course, not the only hazard that must be guarded against. The bomb is likely to ignite any combustible contents near it, and the resulting fire, the side walls and roof. As protection, the side walls and roof rafters can be covered with boards made largely or wholly of incombustible materials, such as cement-asbestos boards or gypsum wall boards, or with plaster on metal or gypsum lath. Some degree of protection can also be obtained with heavy coats of sodium silicate, whitewash, borax paints, or other fire retardant coatings applied with brush or spray. Spaces along the walls into the construction beneath should be blocked with the floor covering material or other incombustible fill.

The floor covering, as well as wall and ceiling facings, would afford added heat insulation and heat capacity and thus tend to make the house more comfortable in both summer and winter. There would also be a gain in safety from common fire hazards.

Protections similar to those outlined above can also be applied on wood-framed flat roofs, but preferably should be not less than 3 or 4 inches thick to give the needed additional resistance to penetration required for a stopping layer in this location. The advantage within limits of using lightweight materials is apparent in decreasing the load on the structure and increasing heat insulation, particularly for ordinary temperature conditions. The protecting layer should be anchored into masonry or other exterior wall construction, and be waterproofed or otherwise covered to form a weather-tight covering. Sloping roofs, while requiring less thickness of protection, introduce greater difficulties in application, considering also the types of roof coverings over which it would generally have to be applied.

Between the stopping layer and any refuge room within the building there should preferably be an intervening floor equivalent in resistance to impacts to a single-board wood floor. This gives additional resistance to penetration and to impacts from falling materials in case of disruption of the construction under the stopping layer.

Substitutes.

By Curtis R. Welborn (Member N.F.P.A.),
Secretary, Underwriters' Laboratories.

To those with experiences in international armed hostilities, it is horrible to study the parade of events in the world affairs. We are at war, and those of us who enjoy our country's blessings can do nothing less than strain every muscle and use every ounce of ingenuity to bring these hostilities to a victorious conclusion.

Underwriters' Laboratories has this viewpoint and is working towards this goal.

The Laboratories' enterprise, in performing its normal functions, is so interwoven into the industrial and social fabric of the nation that this is a logical place to secure a brief recitation of how priorities are forcing some of the manufacturing world, the using public and the government to make a more generous use of emergency alternatives, leaving available a greater proportion of our production of strategic materials for the manufacture of munitions and war supplies.

Underwriters' Laboratories, Inc.'s part in the armament program is a modest one; nevertheless, we are making an effective contribution. We have accepted a number of departures from established practices as emergency alternatives in the products we list or label under our forms of factory supervision. Our policy is to coöperate in all efforts to conserve strategic materials in so far as this can be accomplished without undue sacrifice in necessary safety.

A substantial percentage of our laboratory work and factory inspection service is in and for the electrical industry, and this business is a large user of most of the strategic materials. One of the biggest consumers in the world is the United States Government. Its Specification Board, together with many other of its divisions, has paid us the compliment of stipulating in many specifications and purchase requirements that the listing and labeling of Underwriters' Laboratories is *prima facie* evidence of compliance with their specifications.

Since a great customer and one of our outstanding supporters was among the first to feel the impact of priority restrictions, it became necessary to establish at once an orderly procedure for recognition of emergency alternate materials. The following course was determined and we follow it:

(a) Recognition of substitutes to be on the basis of an emergency alternative, and recognition to cease when the emergency is past.

This article was presented as a paper before a meeting of the Agricultural Committee, National Fire Waste Council, U. S. Chamber of Commerce, Chicago, Dec. 2, 1941.

(b) Recognize whatever substitutes are formally announced as emergency alternatives in the Federal specification on products which we list and follow up, thereby duplication of industry consultation will be avoided since industry has already contacted with the Federal Specification Board.

(c) Be certain that the Federal Specification Board and its priority contacts agree as to the existence and extent of an emergency before announcing amendments to our Standards or requirements recognizing emergency substitutes.

We collaborate very closely with our manufacturing-subscribers and in many of these groups, have an Industry Advisory Conference. Where such Advisory Conferences are organized and functioning, problems affecting Standard changes are thoroughly discussed with them. When it becomes necessary to act upon the decision to develop emergency alternate Standards, our procedure is most likely to take the following course:

(a) Discussion of the problem with Industry Advisory Conference, either by correspondence or in conference assembled.

(b) Bulletin to the entire Industry with a short interval for comment.

(c) Final bulletin placing the alternate emergency Standard in effect.

The October 21, 1941, Conservation Order M-9-C, which practically forbids the use of copper for many civilian products, states that the prohibition and restriction of Paragraphs (a) and (c) of the order shall not apply to the use of copper or copper-base alloys in articles which are being produced:

"For use to comply with Underwriters' regulations or safety regulations issued under governmental authority, provided the pertinent provisions of such regulations were, in either case, in effect both on October 1, 1941, and on the date of such use, and specifically and exclusively require the use of copper or copper-base alloy to the extent employed, or, primarily as conductors of electricity, but this exception shall be applicable only to the extent necessary to permit the conducting of the electricity required."

We are reliably advised that the intent of this exception is to incorporate the work of Underwriters' Laboratories. It perhaps means that some relief will be experienced by those industries using large amounts of strategic materials and whose products are supervised under the services of Underwriters' Laboratories.

We have coöperated fully and promptly with industry and OPM and determined emergency alternates wherever it has been possible to do so. Following are some, but not all, of the adjustments made in our operations for the conservation of strategic materials:

Article	Accepted Construction	Alternate
Armored Cable Tape	Red, orange, or yellow color.	Brown color.
Fan blades in gas-mixing system	Aluminum, sheet.	"Textalite," a cotton base phenolic composition.
1-Qt. siphon paint container in spray booth	Aluminum, sheet.	Steel, electro-zinc plated.
4½-in. O.D. cylinder, air separator pump chamber in power-operated discharge device	Aluminum or galvanized.	Japanned steel.
Industrial oil burner fan	Aluminum.	Lead-coated sheet steel.
Domestic oil burner fan	Aluminum.	Lead-coated sheet steel.
Indicator post target	Aluminum.	Bronze.
Bus-Bar connector on gun type oil burner	Brass.	Cadmium-coated steel rod.
Hose clamp on 2½-gal. extinguisher	Brass.	Steel, galvanized or cadmium-plated.
Name plate on 2½-gal. foam type ext. and 2½-gal. soda acid extinguisher	Brass.	Decalcomania transfer.
Name plate on 1 and 1½-qt. vaporizing liquid extinguishers	Brass.	Decalcomania transfer.
Nuts for copper tube fittings for oil burner stoves and burner units	Brass.	Steel with cadmium, copper or galvanized coating, electrolytically applied.
Heater Receptacle ring busses and screws	Brass.	Nickel-plated steel busses; plated-steel screws.
Tubing fittings for domestic oil burners, oil burning stoves, and burner furnace units	Brass.	Cadmium-plated steel.
Valve closure springs in hose nozzle valves	Phosphor bronze.	Cadmium-coated steel.
Union Nut — SAE design on oil burning stoves	Brass copper tube fittings.	Zinc-plated steel.
Stems of O.S. & Y. gate valves	Rolled bronze.	Manganese bronze.
Bolt mechanism on safe doors	Cadmium-plated steel.	Nickel-plated or copper-plated steel.
Current-carrying parts of electrode receptacles	Copper or copper alloy or phosphor bronze.	Spring steel wire plated with cadmium or zinc.
Appliance wiring material in radio receivers	Heat-resistant, rubber-insulated copper.	Smaller size conductor (No. 24 AWG) recognized.
Oil burners for stoves and ranges	Copper tubing.	Reduced wall thickness from 0.049 to 0.032 min. A.E.S.
Toy transformers, supply conductors	Rubber-insulated conductor.	Supply cords reduced from 6 to 4 ft. minimum length.
Leads on pendant weatherproof lampholders	Rubber-insulated conductor.	Reduced from 6 to 3 in. minimum length.
Flexible cord in telephone booths	Type POSJ-32 (Rubber jacket.)	Type AF asbestos-covered fixture wire.
Electric cord in oil burning stoves	Types S or SJ (Rubber jacket.)	AF and CF wire enclosed in two outer jackets of cotton braid. Outer jacket to be lacquer impregnated.

Article	Accepted Construction	Alternate
Supply cord for cooking appliances and bottle warmer	Type POSJ-32, labeled (Rubber jacket.)	Labeled POSJ-64 cord with ¾-in. varnished cambric sleeve over individual conductors where passing through bushings in cup wall.
Wiring on oil burning stoves.	Type SJ electric cord (Rubber jacket.)	Type AFPO with extra saturated cotton braid.
Fire Hose.....	Flax lined and flax tow.	Change in material specifications permitting other fibers.
Gasket on power-operated pump	Neoprene.	Rubber.
Curb box of liquefied petroleum gas systems.....	Sheet steel, 14 and 12 gauge.	16 gauge sheet metal.
Panel on back of domestic refrigerator	Sheet steel.	Woodall fiberboard.
Shell of underground storage tanks, 1100-gal. and smaller	Galvanized iron—14 gauge.	10 gauge black steel.
Shell of inside or underground storage tanks.....	Galvanized iron.	"Seconds" galvanized iron. Painted with red lead and asphalt A.E.S.
Pan under burner of domestic gas-operated refrigerator..	Sheet steel.	¼-in. asbestos.
Tin-clad fire doors—to be used when present supply of original material is exhausted	Terne plate.	Terne plate having 10 per cent reduction in tin.
Tin-clad fire doors.....	Terne plate.	Sheet steel, painted.
Die casting.....	Zinc-plate alloy.	Alloy with reduced aluminum content. Federal emergency alternate specification.
Meter body and covers hazardous liquids.....	Zinc-base die casting.	Cast-iron, lacquered.
Contacts on vacuum tube sockets	Phosphor bronze or brass.	Plated steel.
Length of appliance cord sets	Six feet of Types HC, HPD, HSJ heater cord.	Reduction in length of heater cord.
Thickness of copper for clips in electric signs.....	0.045 in.	Increase width to ⅝ in.; and 0.040 in. thickness.
Gasoline hose couplings.....	Brass.	Coated ferrous metal.
Electric metallic tubing.....	4 Dip ($CuSO_4$ Test)	2 Dip ($CuSO_4$Rt) reduced zinc coating.
Couplings (2½-in. single-jacketed cotton rubber-lined fire hose).....	Brass.	Coated malleable iron. Low copper content brass swivel.

There is no practical yardstick with which to measure with any degree of accuracy the saving of strategic materials due to the use of the foregoing alternates, with the exception of the last one — Fire Hose Couplings.

If the U. S. Office for Civilian Defense purchases fire hose in the amounts reported to us (approximately 40 million feet) and uses the emergency alter-

nate construction there will be a saving of nonferrous metal of about 47.5 tons per million feet of hose.

The generous use of emergency alternates may be disquieting, but there are perhaps two comforting thoughts: the first one, discussed at length by Mr. Cameron of the Ford Motor Company in a recent Sunday evening's broadcast, some of which might be summarized as follows: "In addition to these formal emergency alternate specifications there are changes taking place which should not be considered as substitutions in the sense of denoting an inferior product. This is a class of change that would be permissible at any time; involving no change in existing standards and usually concerns the use of a more costly material or one more expensive to fabricate." The second is: As a people, we are prone to demand and secure the "gold-plated" for our everyday usages and as a result, there may be many alternate materials that have never had a chance to prove their worth. Out of this National Emergency may come some alternates that are better than the materials they replaced. Who knows?

Substitutes for Brass Fire Hose Couplings.

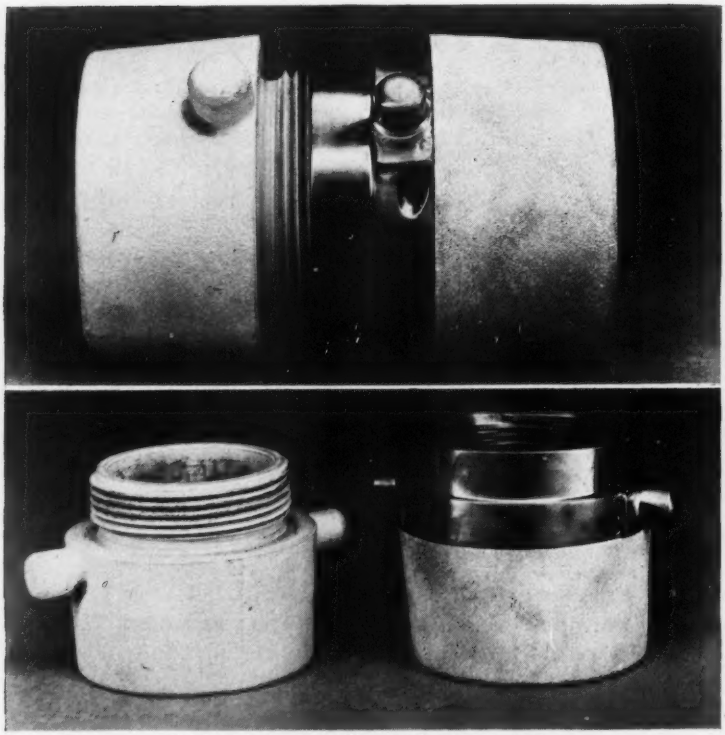
Last July the Office of Production Management asked President Alvah Small of Underwriters' Laboratories, Inc., how far malleable iron or other metal could be substituted for brass in couplings on fire hose. The problem had come up in connection with the purchase of large quantities of hose for use in fire departments in Army camps and for delivery abroad under lease-lend commitments. The couplings for the British hose, a snap type, presented a somewhat more important problem than the American because they are heavier and contain more metal.

Underwriters' Laboratories immediately started some preliminary investigations and on September 3 a meeting to which 25 manufacturers of fire hose couplings were invited was called at Underwriters' Laboratories, Inc., Chicago.

At this meeting the use of various substitutes was discussed. Gray cast iron, forged steel and plastics were for one reason or another reported impracticable. Malleable iron, however, could be used in the opinion of many of those present. The opinion was expressed, however, that a brass swivel would be needed. This would provide a male malleable iron thread engaging a female brass one which judgment indicated would work almost as well as the present all-brass thread connection.

The discussion developed that corrosion was probably not the most serious problem, although it would be investigated.

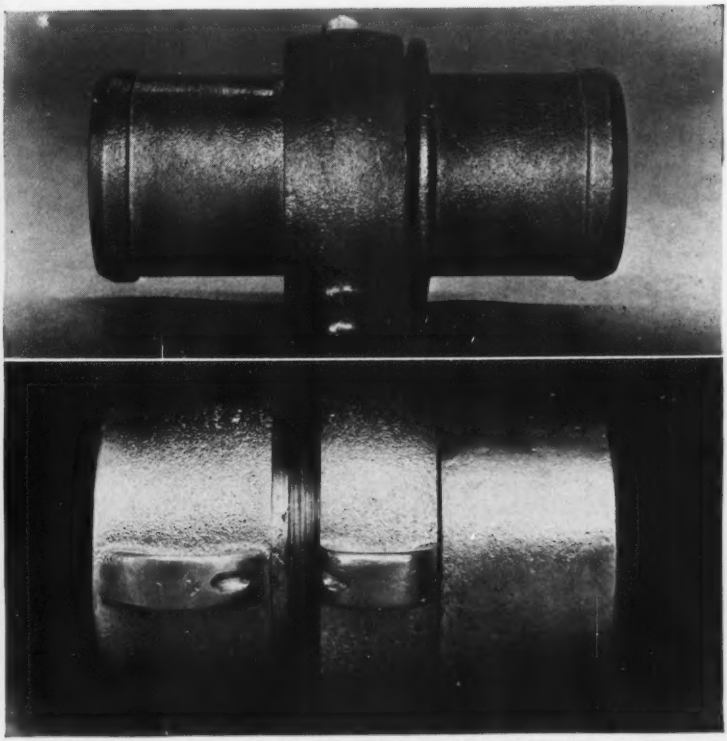
Present practice in fire hose couplings provides that the hose engages a tail piece into which it is held by an expansion ring. This provides a smooth waterway and is a type of coupling which has given excellent service over a



Malleable iron coupling with brass swivel.

period of years. One possibility which everyone appeared to feel should be investigated was the use of a shank type coupling. In the shank type the hose fits over a shank or nipple and is clamped to it by a ring clamp. This does not give quite as smooth a waterway as the expansion ring type, but from the standpoint of meeting the emergency situation where the saving of metal is required, the shank type coupling would have one important advantage — it requires only about half as much metal as the expansion ring type.

At the September 3 meeting, a group of the conferees was asked to prepare a preliminary draft of specifications, to obtain sample couplings, to conduct further tests and report to a meeting of the entire group to be held on September 24 at Underwriters' Laboratories. This group was headed by R. W. Hendricks, Hydraulic Engineer, Underwriters' Laboratories, Inc., Chicago, Chairman of the N.F.P.A. Committee on Hose Couplings and Nozzles. Assisting him were E. E. Hansen, Sales Manager, Elkhart Brass Manufacturing Company, Elkhart, Ind.; H. E. Meng, Vice-President, W. D. Allen Manufacturing



Shank coupling for 2½-inch cotton rubber lined fire hose (above) compared with conventional expansion ring type (below).

Company, Chicago; H. M. Frecker, Eureka Fire Hose Company, New York, representing the Technical Committee of the Rubber Manufacturers Association; and J. A. Durr, Development Engineer, the Malleable Founders' Society, Cleveland.

At the second meeting on September 24, the group reported favoring the development of an expansion ring type of malleable iron coupling. The expansion ring type was favored because (1) fire departments are equipped with the necessary tools for applying them, (2) the coupling provides a full and smooth waterway without obstruction, and (3) the method of attachment is more satisfactory and less likely to cause delay and trouble. This conclusion was based on a number of tests made of shank type couplings. The amount of brass required would be substantially the same for both expansion ring and shank type couplings.

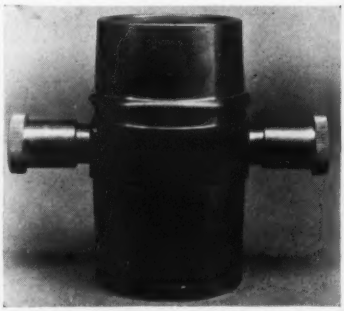
Features of specifications for the emergency type hose couplings which were agreed upon then were: an expansion ring type coupling of malleable

iron with a brass swivel made of 68 per cent minimum copper; wire ring connection of brass or steel wire, and brass expansion rings. The usual alternate methods of lug design and swivel engagement are accepted. Over-all protective coating is to be required.

It was agreed that alternate specifications for shank and clamp couplings would be provided. While such specifications have been prepared by Underwriters' Laboratories, the present indications are that the expansion ring type will be principally used.

It was also agreed that British couplings furnished under lease-lend commitments would be furnished of the malleable iron type.

The investigation carried out at Underwriters' Laboratories included a great many thoroughly practical tests. For example, the malleable iron couplings were given rough usage tests. A set of 2½-inch couplings of the expansion ring type made entirely of malleable iron was attached to a 10-foot length of 2½-inch cotton rubber-lined hose. The hose and couplings were dropped eight times from a work bench to a concrete floor, a distance of 3 feet. The 10-foot length of hose was then doubled in the middle and the couplings were dragged back and forth rapidly over iron trench covers in Underwriters' Laboratories' hydraulic laboratory five times. During this test the couplings were dragged approximately 800 feet.

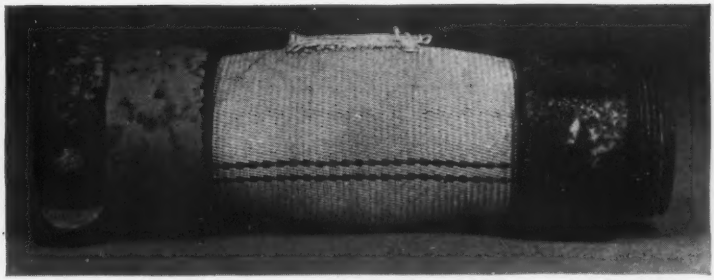


A hose coupling of British pattern. British couplings are snap type and weigh about seven pounds as compared to six pounds for the common American screw thread type.

With the hose doubled as in the previous tests, the couplings were dragged rapidly for a distance of six blocks over a street paved with granite cobblestones. The couplings and hose were then violently thrown on a concrete floor from a height of about 12 feet. This was repeated four times.

Examination of the couplings after the rough usage tests showed no evidence of material injury to the couplings, although the external surfaces were somewhat marred. No serious abrasion of the galvanized swivel of the female coupling was apparent, although there was some evidence of the battering this member received. The swivel turned freely, showing that it had not been deformed. The couplings were finally recoupled to a 3-foot length of 2½-inch double jacketed hose and given a hydrostatic pressure test up to the point where the hose burst at 740 pounds per square inch. This test showed that the strength of the couplings had not been affected by the rough usage.

A set of malleable iron couplings of the expansion ring type was exposed to the weather on the roof of the Laboratories' buildings and subjected to alter-



Although still usable after a month of exposure to weather, this 2½-inch hose coupling sample of all malleable iron demonstrated that such couplings require corrosion resisting coatings. Accelerated corrosion tests on various protective coatings are currently being conducted by Underwriters' Laboratories, Inc.

nate wetting and drying for a period of one month during which there were frequent rains. The couplings had no protective coating, and although the external surfaces rusted quite badly, no difficulty was experienced in rotating the swivel or in joining the male and female couplings. The test showed clearly, however, the need of a metallic protective coating for couplings having malleable iron parts.

A similar test was made of a set of 2½-inch couplings of the expansion ring type made of malleable iron with a galvanized protective coating. After 30 days' exposure to the weather, a slight amount of rust was apparent on the threaded end of the male couplings and over about two-thirds of the internal surface area of the tail piece. The rusting of the male thread did not interfere with the threading of the couplings.

These and other preliminary corrosion tests indicated the desirability of further study of corrosion and protective coatings, which were continued by Underwriters' Laboratories and which are still going on.

Underwriters' Laboratories presented the findings of its researches and the deliberations of the manufacturers' committee on November 1 to the Office of Production Management. Its report is comprehensive, but the following conclusions summarize the principal findings.

In these conclusions reference is made to emergency specifications in which the features summarized above were expressed. Underwriters' Laboratories has a draft of these specifications for those interested and they have also been issued as Federal Emergency Alternate Specification for Couplings for Fire Hose — Cotton Rubber-Lined and Linen Unlined, No. E-WW-C-621-a.

Conclusions.

I. **Practicability of Couplings:**

Malleable iron male couplings and female couplings with brass swivels and malleable iron tail pieces are practical as equipment for emergency fire hose.

II. **Durability of Couplings:**

Fire hose couplings having a male coupling made of malleable iron and a female

coupling consisting of a brass swivel and malleable iron tail piece will, if the malleable iron parts are properly protected against corrosion, prove to be sufficiently durable for emergency use.

III. Strength of Couplings:

(*a*) Fire hose couplings of the expansion ring type, designed in accordance with the specifications herewith, involving a male coupling made entirely of malleable iron and a female coupling with a brass swivel and a malleable iron tail piece, will have adequate strength to withstand the stress incident to expansion of the expansion rings in the tail pieces; to withstand the stress resulting from expansion of the tail piece of the female coupling for the interlocking and for the grooved form of swivel attachment; and to withstand the ordinary service stresses and the rough usage to which fire hose couplings are likely to be subjected.

(*b*) Shank type fire hose couplings, conforming to the specifications herewith for couplings of that type, will, likewise, have adequate strength to withstand the stresses and rough usage to which they are likely to be subjected.

IV. Reliability in Service:

Fire hose coupling sets consisting of a malleable iron male coupling and a female coupling with a malleable iron tail piece and a non-ferrous swivel will, if designed and constructed in accordance with the specifications, prove to be reasonably reliable for emergency service.

V. Expansion Ring Type Couplings vs. Shank Type Couplings:

Expansion ring type couplings are more practical and preferable to couplings of the shank type.

VI. Deterioration of Hose:

If fire hose couplings of either of the two types dealt with in this report are designed in accordance with the specifications and are provided with protection against corrosion as therein required, neither the cotton fabric nor the rubber lining of the hose will be unduly subject to deterioration resulting from contact of these materials with the couplings.

VII. Foundry and Machine Tool Equipment:

(*a*) New patterns probably will be necessary.

(*b*) Modern machine tool equipment which has been used in the production of fire hose couplings made of non-ferrous material can be utilized in the production of couplings having malleable iron tail parts, but the rate of production may be reduced by about 30 to 50 per cent.

New Hazards of Dry Cleaning.

By Robert S. Moulton,
Technical Secretary, N.F.P.A.

The shortage of chlorine due to its extensive use for National Defense manufacturing is resulting in a shortage of carbon tetrachloride and other non-combustible or so-called synthetic solvents used for dry cleaning. A serious hazard is being created where combustible solvents are substituted for non-combustible solvents.

The dry cleaning industry for many years was considered inherently hazardous. A long record of fires and explosions made fire chiefs and insurance men wary of the hazard and there were few dry cleaners who had been in the business for a long time who did not show scars from burns. As a result of the fire experience, the industry was largely regulated by laws and ordinances and its operations were restricted to separate buildings well away from locations where large numbers of persons congregate and well away from high value districts. This was on the theory that fires and explosions in this process were more or less inevitable and that the business should accordingly be conducted in such a way that the fires and explosions that were bound to occur would cause a minimum of damage to other property and would not needlessly endanger the lives and safety of the public.

Over a period of years research in the industry resulted in the development of safer methods. Special forms of extinguishing equipment, new types of cleaning machinery designed to use gasoline and similar solvents more safely, special types of construction, electrical installation, etc., reduced the hazard. One very significant factor was the development of so-called "Stoddard Solvent" and other special solvents in this class which are specially refined petroleum products designed to have the cleaning properties of gasoline, but having fire hazard properties only in the same class with kerosene. The use of these safety solvents serves considerably to reduce the hazard, but even where the safety solvent is substituted for gasoline or naphtha, the business of dry cleaning involves special hazards which call for its restriction to isolated locations, except under certain special conditions which will be discussed below.

In recent years there has been a great increase in small-scale dry cleaning operations using special equipment designed for carbon tetrachloride and other similar non-combustible solvents. Small machines involving a much smaller investment than standard equipment of the regular dry cleaning plant have been installed in small laundries and shops of one kind or another. Often these are located in buildings housing a large number of people in the con-

Firemen fighting a fire in a small dry cleaning plant. The dry cleaning machine contained about 40 gallons of low flashpoint solvent.

gested business districts of cities. Their presence has been permitted only because the solvents used are non-combustible and therefore there is, in theory at least, no fire and explosion hazard.

Now that the supply of non-combustible solvents is curtailed, the operators of these small cleaning plants are faced with a difficult problem. They are under a considerable pressure to continue their business and are likely to do so using any solvent they can get without regard to the fire and explosion hazard, unless it is called very forcefully to their attention by fire authorities. The use of ordinary naphtha or gasoline presents an obvious hazard. The use of the so-called safety solvents with a flashpoint of around 100° to 140° also presents a hazard, but not so obviously. These high flashpoint solvents will not normally give off explosive vapors so long as the temperature is kept below the flashpoint of the solvent. However, these "safety" combustible solvents gen-

erally leave an odor in the garments that are cleaned unless heat is applied in the drying process. Under ordinary conditions it is necessary to heat the material to higher than the flashpoint of the solvent in order to secure satisfactory drying and deodorization. When a combustible "safety" solvent is heated to above its flashpoint, it may be just as dangerous as gasoline or naphtha under ordinary temperatures.

There is available special equipment in which these combustible "safety" solvents can be used with reasonable safety. Such equipment involves special safeguards in the drying operation to prevent the development of explosive mixtures. Unless the small dry cleaner who is now located in a building of multiple occupancy in a business district can secure an adequate supply of a non-combustible solvent or has special equipment of the type necessary to use the 100° to 140° solvents safely, the only thing he can do is to discontinue his cleaning in that location and have this work done somewhere else where it will not be a public menace.

Underground Gasoline Tank Protection.

By Capt. Ray Hatfield,
Los Angeles Fire Department.

To assure reasonable safety in underground storage of flammable liquids, we in Los Angeles feel that the following items should be considered:

(a) Protection of underground tanks against soil corrosion.

(b) Protection of underground tanks against electrolysis.

(c) Protection of underground tanks against mechanical injury.

In our opinion, the specifications for underground storage tanks* as set forth by the Underwriters' Laboratories, Inc., are reasonably adequate with the exception that it has not been the policy of the Los Angeles Fire Department to permit the installation of underground storage tanks constructed of No. 14 gauge material.

Chemical properties of soils differ materially. Our records would indicate that in some locations within this city, tanks have proved serviceable for 20 years or more. At other locations, they have become pitted and corroded to the extent that they leak within a period of three years. In the locations where tank failures appear prematurely, we require that additional protection be furnished by a mastic covering of asphalt or other suitable material.

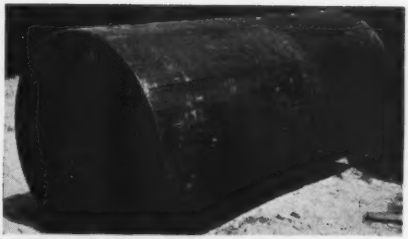
The problem of guarding against electrolysis is a difficult one. We have not found the answer. We have noted that this condition arises in close proximity to trolley lines, high tension lines, and improperly installed electrical wiring underground.

As far as mechanical injury is concerned, we have taken care of this matter reasonably well. Our Code requires that underground storage tanks be buried not less than four feet under the natural grade surface.** To insure against flammable liquids or vapors seeping into basements, etc., in case of tank failures, we require that tanks be installed thirty feet or more distant from any basements, etc., or one foot below their floor level.**

Because of the present emergency, the Bureau of Fire Prevention, Los Angeles Fire Department is faced with many problems concerning the construction of underground tanks. We have had many demands for these tanks to be constructed of used material. Before used material is considered, we re-

*These specifications are based upon N.F.P.A. standards, which provide for a minimum thickness of metal, depending upon the size of the tank. The N.F.P.A. standards specify 14 gauge steel for 560 gal. or less tanks, 12 gauge for 561 to 1100 gal. tanks, and 7 gauge for tanks of 1101 to 4000 gal. Steel thinner than 7 gauge is required to be galvanized.—Ed.

**These requirements are more stringent than N.F.P.A. standards, which specify burying 2 ft., or 12 in., with a 6-in. reinforced concrete cover, and provide a sliding scale of distances to basements depending on the size of the tank. Gasoline tanks of less than 550 gallons are not restricted with relation to distance to basements by the N.F.P.A. standards, and gasoline tanks up to 2000 gallons may be installed 10 ft. from basements.—Ed.

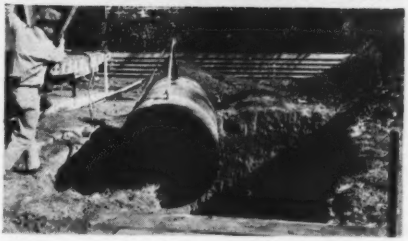


550-gal. gasoline tank, lifting lugs attached, ready for protective covering.

Application of first coating of asphalt and laying of felt paper while asphalt is still hot.

Application of second and final coating of asphalt on top of the felt paper.

The finished tank, completely coated and ready for installation. (Tank in background not yet coated.)



Lowering the tank into the excavation, with care to prevent any injury to the protective coating.

quire that it be sand-blasted and each piece of metal inspected rigidly. If found to be serviceable, we permit its use. We have found under the present emergency that it is almost impossible for the manufacturers to secure galvanized sheet metal. In the face of this fact, we have permitted the manufacturers for the duration of the present emergency to use the same thickness of blue annealed steel as the Code requires for galvanized steel.

To offset the absence of the galvanized protection, we require that these tanks be protected with two coats of asphalt, and between these two coats we require a complete covering of burlap saturated felt weighing not less than 15 pounds per 100 sq. ft. or asbestos sheet not less than $\frac{1}{8}$ in. thick.

To further insure the installation of these tanks without damaging the protective coating, we require that lifting lugs be welded to the tanks themselves so that the tanks can be handled by a crane or block and tackle during installation without injury to the protective coating.

The matter of determining when underground storage tanks develop a failure can best be accomplished by questioning the operator of service stations, or places where other installations were made, with reference to their input and delivery. If there is a wide discrepancy we cause a test to be placed on the tank in question, and if the test discloses leakage, then the provisions of our Code, which are adequate, will permit us to require the operator to remove the tank, either for repair or replacement.

Our Code further gives us the authority to cause any underground storage tank which has not been in service or in actual use for a period of ninety days, to be placed back in service or to be abandoned.

Our method of abandoning underground storage tanks is that the tank be removed or that it be filled with sand, concrete, or some solid substance. This provision may seem rather severe, but from an administrative viewpoint it is about the only way we have found that we can control the hazard of underground storage tanks which are not being used. If they are forgotten, eventually the results will be disastrous.

Fall River Rubber Fire.

By Stephen C. Garrity,
Massachusetts State Fire Marshal
(Member N.F.P.A.)

The largest single industrial fire loss in recorded history occurred on the property of the Firestone Rubber and Latex Products Co., Fall River, Massachusetts, when fire started in an unsprinklered dryer on the evening of Saturday, October 11, 1941. The spread of the fire was stopped on October 12, but the huge stock of rubber continued to burn for another week. The property destroyed included two large and several smaller manufacturing buildings, a large group of old buildings used for rubber storage, some 14,000 tons of rubber, and some property outside the main plant. The direct monetary loss has been estimated at $11,000,000, but the loss is much more serious than indicated by the dollar value alone, owing to the destruction of such a vast quantity of crude rubber urgently needed for war materiel production, and irreplaceable under present conditions.

Section 3 of Chapter 148 of the General Laws (Tercentenary Edition) of the Commonwealth provides that the State Fire Marshal may investigate or cause to be investigated the circumstances of any fire occurring anywhere within the Commonwealth.

In order to clarify all circumstances pertaining to the fire at the Firestone Rubber and Latex Company plant at Fall River on October 11, 1941, an investigation was made, including an inquest held at the Fall River Fire Headquarters on October 17, 20, 21, 24 and 30, 1941, at which witnesses testified under oath, and the cause of the fire was determined.

Description of Property.

Four years ago, the Firestone Rubber and Latex Company purchased the Cotton Mills and Print Works Division of the former American Printing Company, located north and west of Water Street, in the city of Fall River. The Cotton Mills group, in the east yard, comprises the older buildings, some of which were constructed during and prior to 1868. The Cotton Mills group, in the west yard, was constructed during the "nineties," and one or two of the main buildings were constructed about 1901.

During the past four years the Firestone Company has rehabilitated most of the buildings and adapted the west or Cotton Mills group for manufacturing purposes. During the last year and a half, the Print Works group has been reconditioned for storage purposes.

J. C. McKenna, Jr., Courtesy of Providence Journal.

This panoramic picture, taken on the morning of October 12, shows the extent of the damage. The ruins of Buildings 4 and 5 may be seen through the smoke at the left. The rubber burning in the storage building at the right is said to represent 10% of the entire U. S. rubber reserve, irreplaceable under present conditions.

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Construction.

All of the larger buildings in both groups have plank on timber floors and plank on timber roofs, with tar and gravel covering. Nearly all roofs have overhanging cornices. The buildings in the easterly group, commonly known as the Tower Buildings, had granite walls, and those in the westerly group, brick walls. The inside stair and elevator cut-offs in the easterly group were mostly 2-inch plank and many of the elevators had automatic wood hatches only at floor level. In the Cotton Mills group, the cut-offs at the inside stairs and elevators were of both types, but in Building No. 5 the southwest stairway was brick enclosed, and the northwest stairway was cut off by cement plaster on metal lath enclosures. The fire cut-offs between buildings in the Print group were few and incomplete, according to plans. In the group of buildings between Buildings Nos. 5 and 4, there was a 4-story building, known as No. 41 at the north end, and a 2-story building, a former Engine House, known as No. 9 and No. 10, at the south end. The courtyard between measures approximately 100 ft. between Buildings Nos. 4 and 5, and about 195 ft. between Buildings Nos. 9 and 41.

The walls between No. 41 and Buildings Nos. 4 and 5 had many wired glass, steel frame windows in all floors, and standard, metal-clad fire doors at door openings. The cut-offs between Buildings Nos. 9 and 4, and the adjoining Nos. 10 and 5 were brick walls with approved fire doors in the openings. Floors in Building No. 5 were 4-inch plank, with 1-inch hardwood overlay, and there were some openings in the floors of No. 5 not mentioned in the above description. Outstanding among them was a belt conveyor opening between the third and second floors at the north end. The distance between the nearest buildings of the second group, that is, the center east wall of No. 4 and the southwest corner of No. 117 of the Print Group, was about 75 ft.

Occupancy.

For about a year the old Print Works Group was arranged for the storage of baled rubber. Some of the rubber was wrapped; some of it was in wooden boxes. The first two floors in Building No. 101 had been removed to permit high piling and the storage of a larger quantity of stock than would have been possible, due to loading limitations, had the floors remained. During the first week in October, at least 15,850 tons belonging to the Rubber Reserve Corporation, a subsidiary of the Reconstruction Finance Corporation, and approximately 3000 more tons, belonging to the Firestone Co., were stored in this east group. The Boiler and Power House in this group were in service, supplying the manufacturing operations in the west group. These manufacturing operations, among other items, included the manufacture of Airtex pads of various kinds from foam latex, gas masks, barrage balloons, leak-proof gasoline tanks, cartridge clips, rubber thread, and other mechanical rubber and plastic products.

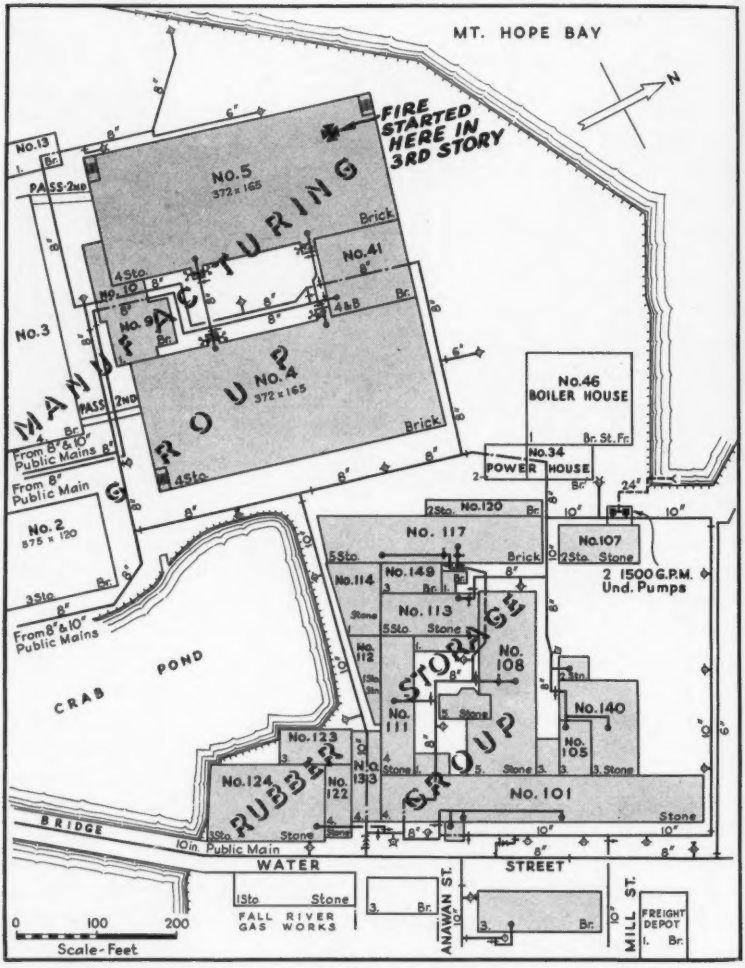


Diagram of the fire area. Shading shows the buildings destroyed.

Fall River Herald.

Fire spread very rapidly through the third and fourth floors of Building 5. This picture, taken at about 11:10 P.M., shows the firemen getting into action. As this picture shows, the fire very rapidly involved the entire third and fourth floors after the sprinklers were shut off.

The Airtex Department was located on the third floor of No. 5, and briefly, the operation consisted of agitating liquid latex, a mixture of rubber, ammonia, water and chemicals. Molding, vulcanizing, washing and drying were some of the operations carried on at the north end of the third floor in modern equipment. Included, also, were a conveyor system and dryers of metal construction. A considerable quantity of finished foam rubber on Airtex pads was stored on this floor prior to removal by conveyor to the stock rooms in the second and first floors. The amount of this finished product was more than 30,000 pounds.

There were several partitions in this area, some closed to the ceiling and others open. There were no flammable liquids used in the process described above, except a small quantity of solvent used in cleaning the equipment. However, part of the third floor of Building No. 41 was used as a mixing room, and several drums of flammable liquids were in storage there also. There was other ordinary flammable material that would be in a plant of this type.

Dryer.

The dryer, known as "B" unit, was built of sheet metal and insulated. The floor of the dryer was the uncovered floor of the room. The dryer measured 20 ft. x 40 ft., and was heated indirectly by hot air passed over steam coils through a fan and ducts to the dryer. It was a circulating system. The temperature of the air in the dryer was maintained between 150° and 170° F., if functioning properly.

After being washed and centrifuged, rubber pads are placed in tiers on metal skids, six or seven of which are run into the dryer on an overhead conveyor. Although the size of the pads varies, depending on use and finished product, the total weight of rubber in a dryer charge runs as high as from 2500-3000 pounds, which this dryer at this time contained.

Protection.

Practically all buildings of both groups were equipped with automatic sprinklers. Some systems, including that in No. 4 Building, were piped according to old schedules. No. 5 Building was built in 1902 with sprinklers according to the new schedule. The east, or old group sprinkler systems had been overhauled within the last year, and were all recently in service as dry pipe systems. Sprinkler risers in No. 5 were both 7-inch and the connection to them from the yard main was in the court with the riser connections from No. 4 Mill directly opposite. The underground fire piping throughout both the east and west yards was of good size, main feeders being mostly 8-inch and 10-inch pipe. The divisional or sectional valves and the yard hydrants were ample in number, and were well distributed. The city water supply was excellent from the standpoint of both volume and pressure, and was available through five connections to a gridiron system of 8-inch, 10-inch, and 12-inch pipe. The volume available in the court between Nos. 4 and 5 Buildings is estimated at about 3500 gallons per minute at 55 lb. residual pressure at yard level. The auxiliaries to this supply were two 1500-gallon steam Underwriter fire pumps, located in Pump House No. 148, which took suction from the salt water inlet, and a 1000-gallon per minute Underwriter fire pump, located in No. 11, which took suction from the Crab Pond. Also, fire department pumpers could readily take suction from a large fresh water pond located between both groups and extending across and southeast of Water Street. Suction facilities were also available in the yard at the shores of Mt. Hope Bay, a tidal inlet.

As far as I know, there was an ample supply of first-aid equipment, including several soda and acid type extinguishers, on the third floor of No. 5. However, the foam rubber pad dryer, described above, was not protected inside by sprinklers. Plans were in process to provide sprinkler protection.

The yard was wholly enclosed by a high wire fence. The Main, or No. 2 Gate, is located on Water Street, immediately south of the shore of Crab Pond.

Providence Journal.

Looking east between Buildings No. 3 (right) and No. 4 (left) at about 1 A.M. Checking the spread of fire to the large manufacturing buildings to the south required the concentrated attention of many firemen.

There is also a gate, known as the Ferry Street Gate, at No. 16 Building, and inside the yard, west of No. 40, is another gate which gives access to a parking lot between the westerly group and the Bay. The Parking Lot Gate can only be reached after passing through the Ferry Street Gate at Building No. 16. From the testimony of the witnesses it is apparent that the Main or No. 2 Gate has always been used by the local fire department.

Uniformed watchmen patrolled the plant every hour, and arrangements had been made to locate a watchman at all times at each gate. Several months ago watchmen had been instructed by the Firestone Company regarding fire protective equipment, and during their rounds were expected to look over the sprinkler control valves to see that seals were not broken. However, the watchmen were not periodically drilled and trained in their duties pertaining to fire hazards and fire protection.

The night shift did not include a fire brigade or fire squad organizations, although it may be said that several members of the mechanical force, including electricians and pipers, were on duty that night. The workers in the Airtex, or foam rubber department on the third floor of No. 5 had not been given training or instructions in fire fighting, or in regard to any available fire protective equipment that might be used, insofar as the testimony or evidence showed. It may be said at this time that the plant was shut down that night, although seven employees were working on the third floor of No. 5.

Story of the Fire.

On October 11, 1941, at about 10:30 P.M. seven men were working on the third floor of No. 5. Shortly after 10:35 P.M., the Latex foreman in the room discovered smoke coming out of the cracks around the doors of the "B" dryer. He opened the door, which he said was then forced open by pressure, knocking him down. The foreman's attempts to extinguish the fire with an extinguisher were futile. He called other employees, asking them to get fire extinguishers while he ran to his office near the stairway in the northwest corner. There he telephoned the Gate House No. 16, requesting the guard to call the fire department. The guard's call was recorded at fire headquarters at 10:41 P.M., as a still alarm, and the box alarm which was sounded after this still alarm was recorded as sounding at 10:42 P.M. It was specified in this call that the fire department should come to the gate at No. 16 Office, known in this report as the Ferry Street Gate.

Meanwhile, some of the other employees in the drying room on the third floor smelled smoke and approached the dryer, and upon realizing there was a fire inside, they ran for extinguishers. However, before they could use them, and before the foreman had returned from his office, the room lights went out. During this time, several of these men observed the sprinklers located above the dryer discharging water. This was corroborated by the fact that the men got wet and most of them had to change their clothing.

It can be assumed from testimony that the door of the oven must have been left open, because of the rapid accumulation of smoke on the third floor, and because of the intensity of the fire in the dryer.

Most of the employees did not deny that the door was open; the others were not in a position to see it open. Smoke poured into the room from the dryer.

The men left that section. Two employees left by a fire escape located on the west side. They went for help. On their way down, they met a watchman in the courtyard between Buildings Nos. 4 and 5, and borrowed his flashlight. They then proceeded to the third floor by way of the fire escape. This was at approximately 10:50 P.M.

Smoke conditions were too severe to permit them to approach the north end of the room. Thereupon, they ran for the stairtower located on the southwest corner. Their testimony shows that they met firemen on the way up, carrying a line of 2½-inch hose, and at about the same time, another employee came up from the second floor and reported there was a fire there at the ceiling. This must have been directly under the dryer.

When another group of the original seven employees reached the first floor of the southwest stairtower, they met a piper, a member of the night shift mechanical force. Upon learning there was a fire on the third floor, the piper ran to the Machine Shop, located on the first floors of Nos. 9 and 10, called an

International.

The furious burning of the rubber storage building severely exposed surrounding property. The freight storage sheds on the left of this picture were finally saved.

electrician, his helper, and another piper. They proceeded up to the third floor and tried to enter the room, but the smoke prevented it. The electrician then, thinking of the safety of the firemen, ran for the sub-station to shut off the power and light lines for Building No. 5. The pipers and helper went to the fourth floor where they crossed over to the entrance to Building No. 41 in the northeast corner, and on the way down through No. 4, they tried to close as many doors as was possible in the interconnecting Buildings Nos. 41, 9 and 10. The doors were hastily closed during the emergency, and, therefore, it is not known how many doors were closed and how many were left open or partly open.

As soon as these employees reached the first floor, they returned to the Machine Shop on the first floor of Buildings Nos. 9 and 10 to rescue their clothing and get more help.

While there, the watchman who had previously been met by two third floor workers at the base of the fire escape in the courtyard, accosted them through the Machine Shop window. He said, in effect, that everything was all right — he had just shut off the sprinkler valves.

It is estimated that the time was about 11:00 or 11:05 P.M. Immediately, the two mechanics jumped through the window and opened the north indicator

International.

Looking northeast across the ruins. The ruins of Building No. 5, where the fire started, are at the left. The narrow passage where the ladder truck was stuck was between the buildings at the right of the chimney. The hydrant that the first firemen found inoperative was near the water's edge at the extreme left of this picture.

post and then ran directly to the south indicator post and opened that valve, upon hearing from the watchman that he had closed it also. The watchman stated that both these operations only took two minutes — to turn off and turn back on again. However, it has been estimated that these indicator posts were shut off at least eight to ten minutes when they were needed most.

Meanwhile, the fire apparatus that came on the still alarm, including the Deputy Chief and two pumpers arrived at the Ferry Street Gate of Building No. 16, and proceeded, without delay, to the southwest corner of the No. 5 Building, by way of the Parking Lot Gate, where one of the pumpers connected to the nearest hydrant. The firemen who carried this line were the ones who were met by the men of the night shift who said they encountered firemen coming up the stairs with the 2½-inch hose line. It was discovered that the hydrant was broken and the line had to be reconnected to another near by. The other pumper immediately dropped a suction line off the cofferdam into Mt. Hope Bay.

The first alarm apparatus immediately followed. The equipment consisted of three pumpers, preceded by a ladder truck. They were directed to enter the yard at the Ferry Street Gate. From this point, however, they proceeded by a devious route between buildings and the ladder truck became jammed at a passage near the No. 8 Building, because of its length. The three pumpers backed out and were followed later by the ladder truck. They left the Ferry Street Gate and went to the Main Gate on Water Street. One of the firemen jumped the fence and broke the lock, permitting the apparatus to enter. No key could be found. Subsequently, the other apparatus entered this Water Street Gate.

Although there was a watchman in Building No. 16, at Ferry Street, and a watchman at the Parking Lot Gate, there was no guard at the Main Gate on Water Street, until after the arrival of the first alarm apparatus.

Other alarms followed in sequence: 10:42 P.M. was the first box alarm, and was followed by a second at 10:59 P.M., and a third at 11:06 P.M.

Upon arrival of the still alarm apparatus, the Chief entered Building No. 5, third floor, in an endeavor to determine the extent of the fire. Although he could not see flame, he said he was driven out by heat and smoke.

Apparently the Power House crew was notified promptly, and the two 1500-gallon fire pumps were started. They operated continuously throughout the night and up until noon of October 12, when one of them was shut down temporarily.

Shortly after the arrival of the second alarm apparatus, flames were observed bursting through the third floor of No. 5 and out of most of the windows, possibly due to the ignition of an accumulation of unburned gases, resulting in what we commonly call a "hot air" explosion. It was at about this time that the valves were shut down by the watchman.

Outside Help Sent to Fall River.

(Table prepared by N.F.P.A. Department of Fire Record)

	Approximate Time of Calls	Miles to Fire	Time of Run Minutes	Pumpers	Other Apparatus	Men
N. Tiverton, R. I.	11:30 P.M.	3	10	1	—	24
Somerset, Mass.	11:30 P.M.	4	10	—	1	35
Swansea, Mass.	11:30 P.M.	5	15	1	1	30
Portsmouth, R. I.	11:30 P.M.	9	15	1	—	6
Warren, R. I.	11:30 P.M.					
	4:30 A.M.	8	30	3	—	42
Bristol, R. I.	11:30 P.M.	11	30	1	—	10
New Bedford, Mass.	11:36 P.M.					
	3:00 A.M.	13	24	2	—	24
Taunton, Mass.	11:43 P.M.	18	19	1	—	7
Westport, Mass.	11:45 P.M.	14	25	1	—	10
Brockton, Mass.	11:46 P.M.					
	3:17 A.M.	30	44	2	2	22
Newport, R. I.	11:52 P.M.	20	25	2	—	18
Providence, R. I.	11:55 P.M.	17	30	4	1	24
Dartmouth, Mass.	11:55 P.M.	14	40	1	—	8
Dighton, Mass.	12:00 P.M.	10	—	1	—	9
Assonet, Mass.	12:02 A.M.	8	23	1	—	5
Middleboro, Mass.	12:05 A.M.	24	35	1	—	8
Seekonk, Mass.	12:30 A.M.	13	30	1	—	10
Naval Training Station, Newport, R. I.	12:50 A.M.	20	30	1	—	6
Fairhaven, Mass.	1:02 A.M.	15	44	1	—	8
East Providence, R. I.	1:20 A.M.	19	20	1	—	7
Attleboro, Mass.	1:20 A.M.	27	55	1	—	6
Barrington, R. I.	1:45 A.M.	10	30	1	—	10
Pawtucket, R. I.	2:30 A.M.	18	25	1	—	7
North Attleboro, Mass.	2:45 A.M.	25	65	1	—	6
Boston, Mass.	3:00 A.M.	53	107	2	2	14
Little Compton, R. I.	3:10 A.M.	15	40	1	—	9
Greenwood, R. I.	3:30 A.M.	26	45	1	—	15
Lakewood, R. I.	4:30 A.M.	23	30	1	—	20
Woonsocket, R. I.	4:45 A.M.	32	65	1	—	10
Greenville, R. I.	4:50 A.M.	24	40	1	—	8
North Easton, Mass.	4:50 A.M.	36	40	1	—	8
Mansfield, Mass.	4:50 A.M.	30	100*	1	—	12
Foxboro, Mass.	5:00 A.M.	38	50	1	—	4
North Kingston, R. I.	5:10 A.M.	32	57	1	—	10
Wareham, Mass.	5:10 A.M.	33	85	1	—	4
Rockland, Mass.	5:20 A.M.	40	50	1	—	11
Stoughton, Mass.	5:21 A.M.	33	42	1	—	9
North Scituate, R.I.	5:30 A.M.	26	45	1	—	18
Marion, Mass.	5:30 A.M.	25	50	1	—	12
Walpole, Mass.	5:30 A.M.	40	60	1	—	16
Hyannis, Mass.	5:30 A.M.	55	120	1	—	12
Plymouth, Mass.	5:35 A.M.	41	70	2	—	16
Abington, Mass.	5:40 A.M.	37	65	1	—	12
Freetown, Mass.	5:45 A.M.	15	25	1	—	5
Hanson, Mass,	5:45 A.M.	35	60	1	—	10
Westerly, R. I.	5:45 A.M.	58	100	2	—	22
Norwood, Mass.	5:50 A.M.	40	55	1	—	7
Weymouth, Mass.	6:00 A.M.	45	75	1	—	11
Worcester, Mass.	6:00 A.M.	65	110	1	—	5
Oakland Beach, R. I.	6:30 A.M.	25	45	—	1	8
Dedham, Mass.	6:45 A.M.	44	80	1	—	7
Millis, Mass.	7:00 A.M.	40	90	1	—	7
Glens Farms, Mass.	—	14	—	1	—	6

*Delayed by broken gasoline line.

Wide World.

Looking down Anawan Street toward the fire. Firemen along Bridge Street made a desperate stand to stop the spread of fire farther east through these closely grouped old manufacturing buildings.

Although the time elapsed could not be accurately stated by witnesses, the most conservative approximation is that the sprinkler valve was shut down for a period of from eight to ten minutes. This is mainly based upon the testimony of the watchman. While the sprinkler was off, the fire gained considerable impetus, as indicated by the "hot air" explosion. From that point on, the sprinklers ceased to be effective. At 11:26 P.M., a general alarm was sounded and apparatus soon began to arrive from near-by towns and cities. The fire progressed rapidly through No. 5 Building.

During the first hour, the wind was blowing from the northwest, but after midnight it turned and came in from west-northwest. According to official weather reports, a light wind was blowing at the rate of from three to five miles an hour. After the interval when the sprinkler protection had been temporarily shut off, it was impossible for firemen to enter the upper floors of the building.

Many hose streams were directed on the fire from the bay side on the west, from the roofs of Buildings Nos. 9 and 10 at the southeast, and from the ground north of Buildings Nos. 4 and 41. Some of the streams from these latter buildings were directed on to the west wall of No. 4, which was exposed to intense heat and direct contact from flames, which, witnesses claim, leaped across the courtyard. Other streams were thrown over the roof of No. 4 from the yard at the Crab Pond and two or more from ladders and towers in the east side of No. 4. The north side of No. 3 was protected by a water curtain directed between Buildings Nos. 3, 4 and 5.

At about 12:20 A.M., fire burst forth at about the same moment on the top floor and on the roof of No. 4. Not only did the center of the west wall of No. 4 ignite directly from the terrific heat, flying brands, and flames, but the wire glass windows in the walls between Nos. 41 and 5, also 41 and 4, must have melted out, and thus permitted a free passage of fire into No. 4 Building. The firemen were driven away from Buildings Nos. 9 and 10, and from the yard of Nos. 5 and 41 and also No. 4.

Fire department efforts were from then on concentrated upon the north walls of Nos. 2 and 3, and upon the west walls of Nos. 117 and 114. The efforts to beat down the fire in Nos. 4 and 5 were hopeless. This testimony and information has also been received by me from State Police Detective John N. Sullivan, who arrived at the scene of this fire at approximately 11:30 P.M. from his home at Taunton.

Many out-of-town fire departments had arrived at the scene, and eight or ten pumpers were taking suction from the Crab Pond located east of the manufacturing group, and south of the storage group. Other pumpers were taking suction from the slip located north of the storage group and power plant. It is probable that forty or fifty streams were in service during the night, mostly from pumpers taking suction from the auxiliary sources.

Shortly after No. 4 became seriously involved, futile attempts were made to shut off No. 5 sprinklers to conserve water. Conditions were too hazardous to permit entrance to the court between Nos. 4 and 5. A similar condition existed in the area between Nos. 117 and 4. The heat and smoke were so intense that firemen could not approach the area, and the divisional valves in the yard system could not be reached.

Firemen did, however, direct hose streams on Building No. 117 from the north end and from the east or rear of that building, but to no avail. The top floor and roof of No. 117 burst into flames at approximately 2:00 A.M. From

International.

The huge store of rubber continued to burn furiously for days. Firemen were kept on duty playing water on the smouldering ruins for over a week. As a result some 5000 tons were salvaged.

then on through the night stands were made by the various fire departments in the storage group, but due to the fact that the buildings were poorly cut off from one another, and that they contained highly flammable rubber, the firemen were forced to retreat.

About 4:00 A.M., the main building of this group known as No. 101 caught fire at several points and finally this unit of the storage group was doomed. From then on the fire departments had more room in which to operate. From the near-by streets and the yard adjoining, they poured many hose streams into the burning structures and onto the exposed buildings on the east side of Water Street. The fire got a foothold opposite No. 124 on the east side of Water Street, but was soon extinguished. It ignited former Building No. 135, opposite the south end of the No. 101 Building, but that was sub-

dued. Former Building No. 125, known as the Fynes Building, and opposite the center of No. 101 across Water Street, was practically gutted by the fire, but the conflagration was stopped at that point. It did not damage No. 126 Building located directly east of the Fynes Building. To the north, the various freight sheds in the direct path of fire to the north and east, were deluged by other hose streams but suffered no damage.

Damage.

Approximately twenty-five buildings and contents were totally destroyed. However, at this writing, 4500 tons of the rubber have been salvaged, and it appears that the total salvage will amount to 5000 tons. These buildings include Nos. 4, 5, 9, 10 and 41, of the manufacturing group. Buildings Nos. 2 and 3 suffered no damage. The fire by-passed the Power House and the Boiler House at the storage group. Both were of non-combustible construction. The Fire Pump House No. 148 sustained very little damage. It was shielded in part by a section of a building formerly known as No. 107, which was of non-combustible construction. It was also wet down by many hose streams. The entire storage group with its 18,850 tons of rubber, less what had been salvaged, was lost. The total fire loss is estimated at $11,000,000, exclusive of indirect losses due to interruption of production and employment.

Cause.

Upon consideration of all the evidence obtained in the preliminary investigation of this fire and at the inquest on same, I find that the fire originated in Building No. 5, "B" dryer, located on the third floor, and that it was caused by spontaneous ignition. This opinion is substantiated by a report of Mr. Matson of the Underwriters' Laboratories, Inc.

Discussion.

There is a possibility that if sprinklers had been installed in the dryer the fire might have been less serious. But as I have stated previously in this report, sprinklers were in the process of installation. The job had been authorized, the pipe had been cut and was on hand.

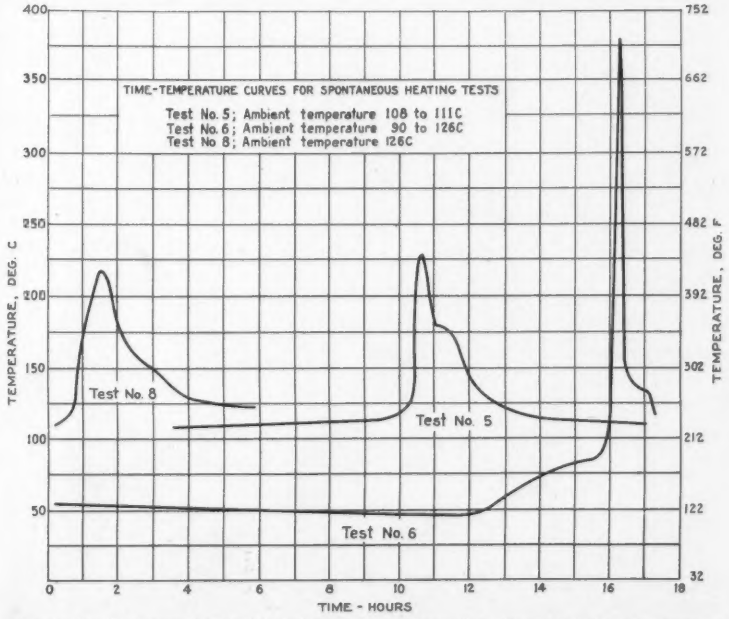
The contents of the dryer, foam rubber, known as Airtex, ignites readily at lower temperatures than sheet rubber or most forms of rubber stock. Also, fire spreads in it much more rapidly, giving off a large amount of flame and heat, and heavy black smoke. In other words, 3000 pounds of foam rubber in a dryer will produce a very rapid spreading fire of great intensity.

During the interim following the discovery of the fire, several employees near by might have acted more effectively had they been properly trained. The lack of instruction as to their duties as watchmen was evidenced by the fact that they ran around aimlessly and finally left the building without using the extinguishers or other first-aid equipment that was available. Had these guards comprised a well-trained fire squad, they at least would have been able

to give an intelligent report to the fire department and possibly have aided the department in ventilating the room and bringing in hose streams for an inside fight.

The vital and climactic act came when the watchman shut off the sprinklers. This allowed the fire to spread rapidly. During the interval before the sprinklers were turned on again (there were more than 600 sprinkler heads on each floor), undoubtedly nearly every sprinkler head on the third floor and many on the second floor had opened. This, in my judgment, overtaxed the water supply and presented an overwhelming handicap when the water was turned on again. Up to the time the sprinklers were shut off, according to testimony and evidence, sufficient water was being discharged in the vicinity of the dryer, due to the very excellent supply and pressure, to prevent the fire from getting out of control.

The watchman who shut the valves off thought he was doing the right thing. He was very honest in his testimony, but his lack of knowledge as to what should have been done in the emergency was surprising. Had he been



Tests by Underwriters' Laboratories, Inc., show that foamed latex (sponge rubber) is subject to spontaneous heating when exposed to initial temperatures of 230° F. to 258.8° F. This is higher than the nominal operating temperature of the dryer, 150° to 170° F., but might occur due to local overheating. Smoke having the odor of charring rubber was evolved during the period of spontaneous heating in all the tests, and the volatile products formed from rubber by heat are flammable.

Providence Journal.

The rubber storage section was still burning furiously on Sunday morning. The gate in the foreground is the one which was locked at the start of the fire, which delayed fire department response.

trained in his duties he would, undoubtedly, have under similar circumstances investigated the fire by entering the area in which it was located. He most certainly would not have shut off the sprinkler protection until he was certain the fire was out.

Later investigation by the fire department and water department of the city of Fall River revealed, however, that hydrants Nos. 15 and 17 were found to be defective, indicating a lack of precaution.

Plant watchmen and guards employed by defense industries must at all times realize the importance of their jobs; but it is the responsibility of the employer to provide suitable instruction and training to guarantee the competence of its personnel. Insurance companies should do more than merely promulgate certain rules, recommendations and instructions to industrial plants, and actively participate in the protection program by periodic inspections by experienced supervisors. It is also recommended that a closer coöperation with the local fire department be arranged by industries engaged in war projects for the mutual advantage of both. The industry would enjoy the practical advice and professional assistance of capable experts who would readily recognize potential fire hazards. The firemen would gain thorough knowledge of the structural plans of the buildings of the industry and a certain amount of information as to the type of material stored therein could be gleaned for preparation in case of fire.

It is also recommended that salvage squads be organized among the regularly employed personnel to serve as a salvage unit. In this instance, although the rubber stored in the various buildings was heavy and bulky, some of it might have been saved. Present conditions indicate the inestimable value of even the smallest amounts of war material.

Undoubtedly, had the protection remained in service the local fire department could have entered the room, after ventilating it, and extinguished the fire in the dryer. It is true that before this could have been done a large number of sprinkler heads would have opened by heat rolling out of the confined fire, and the contents stored in the lower floors would have suffered a severe wet-down. Nevertheless, the fire would not have advanced very far from its point of origin.

The fact that the No. 2 Main Gate, the entrance normally used by the local fire department, was locked and without the services of a guard is another indication of the lack of training of guard and watchman service at this plant. This is further evidenced by the fact that the local fire department had not been notified that one of the main gates had been closed. Although the delay the fire department experienced in reaching the scene of the fire might not have been a vital factor in this large loss, it was contributory.

The Fall River Fire Department under severe handicap accomplished all that could have been expected of it, together with the outstanding coöperation

given by other municipal departments. The delay at the gate, the shutting off of the sprinklers and the lack of competence revealed by the plant personnel were beyond their control. The spirit of coöperation that exists among the fire departments of Massachusetts is always worthy of laudatory comment. They again did all that was humanly possible.

Finally, it cannot be emphasized too strongly that the old, or east group section was not suitable for the storage of vast quantities and large values of combustible material. The buildings were congested and the cut-offs poor. These facts also contributed to the causes which resulted in the fire getting out of control.

There has been a lengthy interim between the moment of the fire and this report. Much that is contained in this document could have been written weeks ago, shortly after the inquest was held. However, because of the ever-existing threat of sabotage it was essential for public confidence that every means of investigation should be employed to determine the cause of the holocaust.

Through the fine coöperation of the Underwriters' Laboratories, Inc., a comprehensive and exhaustive series of laboratory tests were conducted by Mr. A. F. Matson, Associate Chemical Engineer of that organization, to assist the Fire Marshal in the determination of cause. He sustained my opinion that the fire was caused by spontaneous ignition.

Fire Record of Liquefied Petroleum Gases.

The use of liquefied petroleum gases, including propane, butane and various mixtures, has expanded rapidly in recent years. The N.F.P.A. Committee on Gases has kept in close touch with this development and has prepared standards for the safe handling and use of these products. The latest revision, 1940, is entitled "Standards for the Design, Installation and Construction of Containers and Pertinent Equipment for the Storage and Handling of Liquefied Petroleum Gases." It covers the use of these products for domestic, commercial, industrial, motor fuel and other purposes. The fundamental characteristics of liquefied petroleum gases and the basic considerations underlying the N.F.P.A. standards for their use are explained by the Committee on Gases in an informative brochure "Liquefied Petroleum Gas Systems," published in the April, 1938, QUARTERLY and available in separate reprint form.

The fire and explosion experience with liquefied petroleum gas installations has been generally favorable in relation to the large scale use of these products. Fires and explosions, however, have occurred where the safeguards outlined in the N.F.P.A. standards have not been observed. Many states where these products are widely used control the installation and use of liquefied petroleum gases through regulations, based on the N.F.P.A. standards, enforced by the state fire marshal or other authority.

The following typical cases of fires and explosions due to the improper storage and use of liquefied petroleum gases are presented to show the conditions under which these accidents have occurred and to illustrate the importance of full compliance with all the provisions of the N.F.P.A. standards.

DECEMBER 15, 1930. GROUP FIRE. MALIBU BEACH, CALIFORNIA. Although the cause of the fire was attributed to crossed electrical wires, the rapid spread and intensity of the flames were due to the high prevailing wind, the explosion of liquefied petroleum gases stored near the origin of the fire, the frame construction in the colony, including some wooden shingle roofs, the close proximity of the dwellings, and the almost total lack of fire protection. The fire started shortly after 2:00 A.M., and two pumpers responded, the nearest from a distance of three and one-half miles. The fire was brought under control at 5:30 A.M., but fourteen buildings had been destroyed. Estimated loss: $254,000. (H-30454.)

1932. DWELLING. LAS VEGAS, NEVADA. A lighted match resulted in an explosion of liquefied petroleum gas in the basement. Later developments proved that the service line had not been properly tested after installation. At the point where it had been bent to make connection with the meter, the pipe had split, causing a gas leakage and filling the basement with an explosive mixture. (H-44060.)

These ruins of a restaurant in George West, Texas, are the result of an explosion and fire which followed the ignition of liquefied petroleum gas on July 5, 1938. The obsolete and improperly installed underground tank, wrecked parts of which can be seen in the above picture, was not equipped with any recommended safety devices. Careless filling of this tank released vapors which ignited, exploded, and brought death to four persons.

MAY 19, 1932. DWELLING. NEW LONDON, N. H. An explosion occurred in a room housing an electric motor and tanks of liquefied petroleum gas, evidently caused by a spark from the motor igniting escaping gas. The fire was confined to the building in which it started. Estimated loss: $12,000. (H-35059.)

JUNE 2, 1932. MACHINE SHOP AND FOUNDRY. HARVEY, ILLINOIS. As the burners in one of five butane-gas-fired ovens were being lighted, an explosion occurred, wrecking the brick walls and roof of one of the ovens. The next day saw a second, less violent explosion. The cause in each case was leaking butane gas. Loss: $315. (H-35989.)

SEPTEMBER 21, 1932. GROCERY. BARRINGTON, ILLINOIS. A violent explosion caused by a leakage of propane and butane gas mixture took place in the basement of this five-story, reinforced concrete building. The gas escaped from one of four steel cylinders containing about 100 pounds each of the liquefied petroleum mixture. Warning of danger was given two or three minutes prior to the explosion by a hissing noise, the odor of the gas, which had apparently been treated with propylene, a vapor visible about the tank, and a frosting of the shipping cap protecting the valve. The exact cause of the ignition is unknown, but the seat of the explosion appeared to be in the immediate vicinity of the area where the cylinders were first stationed. They were being removed for demonstration purposes on another floor when the explosion came. Property damage was considerable: the concrete floor was cracked and buckled; sprinkler pipes, steam pipes, ventilating equipment, and electrical apparatus were also damaged, including the electric supply line to the fire pump, which consequently failed to function. Two small fires which followed

were extinguished by the use of chemical extinguishers and first aid hose operated by the company's private fire brigade before the arrival of the public fire department. Three employees were seriously injured, and the property loss was estimated at more than $25,000. (S-62999.)

NOVEMBER 10, 1932. SHIPYARD. BAYONNE, N. J. An explosion and fire occurred in a 46-foot cabin cruiser housed in a three-story frame building that was nearly filled with other motorboats. A plumber, engaged in disconnecting water pipes, etc., is believed to have struck a static spark in lifting a brass-bound hatch cover in the cruiser's floor. Propane was the fuel used in the boat's small stove, and though the propane tank had been removed it is thought that some of the gas had leaked out previously. The resulting explosion blew the roof off the engine room, raised the roof of the cabin, and, in the flash fire that followed, burned the plumber in several places. Four sprinklers operated, and these, with two lines of hose used by employees, extinguished the fire within a few minutes. The loss was settled for $10,000. (S-62448.)

DECEMBER 17, 1932. AUTOMOBILE PLANT. DETROIT, MICHIGAN. Butane, spilled in a driveway from a temporary two-inch discharge line that was being used in place of a leaking underground discharge line, was ignited by a spark from an electric truck. The ensuing blaze cracked about 200 lights of glass in the building, though no fire entered the structure and no sprinklers opened. Chemicals, foam extinguishers, and a hose stream stopped the fire in twenty minutes. (S-65878.)

MAY 8, 1934. DWELLING. ISLAND CREEK, DUXBURY, MASSACHUSETTS. One cylinder of a butane-propane gas system, which had been installed in the cottage for hot-water purposes, had become exhausted. The hired man turned off the supply at the heater, changed over to a new cylinder, and went immediately to the cellar to light the burner under the boiler. A leak in the connecting pipe had saturated the cellar with gas and as the man struck a match a terrific explosion took place which burned him severely. A small fire was quickly extinguished. (H-37117.)

JUNE 2, 1934. OIL REFINERY. HUNTINGTON BEACH, CALIFORNIA. A 5000-gallon truck was being loaded with butane by gravity through a closed system from a vertical 15,000-gallon storage tank by means of a three-inch line. The vapor spaces of the storage tank and the truck tank were interconnected by means of a one-inch pipe and one-inch hose so as to equalize the pressure, which was 65 pounds, and permit the return flow of the gas. These tanks, however, had no excess-flow valves installed. The hose in question was of new synthetic rubber, but it had not been tested after the couplings had been applied, and appears to have blown off the coupling nipple in some unknown way. The valve at the base of the storage tank was shut, but the hydraulic internal valve of the tank truck unfortunately was not. The butane vapor that was released was at first like a heavy frozen fog. Five minutes later a flash occurred, igniting six surrounding derricks, five crude oil tanks, part of a small residence, the chassis of the tank truck and some fittings on the adjoining casinghead tanks. All of the tanks involved, other than those containing crude oil, were pressure tanks with adequate relief valves, plug frangible disks or fusible reliefs. These all functioned as designed, none of the tanks blew up, and the vent fires were extinguished by water shortly afterward. Estimated loss: $50,000 to $100,000. (H-38628.)

Tarver Photo.

When escaping butane gas exploded and ignited in Crowley, La., on October 22, 1936, the cause was not difficult to locate. Both the truck and tank involved were of flagrantly sub-standard design and the discharge connection was broken by careless employees. Five persons were burned to death and several buildings were destroyed before the flames were brought under control. A metal trash burner more than fifty yards distant from the scene was the source of ignition.

JULY 2, 1934. INSULATED WIRE FACTORY. NEWBURG, N. J. Steam heat was being used to hasten the transfer of liquefied petroleum gas from a large to a small container. The containers were brought too near a boiler room and escaping gas was ignited by the boiler fire. The small blaze that followed was put out with a hand extinguisher. No claim was made for the small damage. (S-67173.)

NOVEMBER 7, 1934. CHEMICAL WORKS. DAYTON, OHIO. Butane, pentane and other similar hydrocarbons were being cracked in a tube furnace at high temperatures to obtain raw materials to be used in experimental processes. One of the two safety plugs in a cylinder of butane blew out, either through some defect or a mechanical injury. The gas escaped and was ignited by the furnace. Sprinklers, foam, soda-acid, and carbon tetrachloride extinguishers, together with a small hose stream, kept the other cylinders cool and checked the fire before the public fire department arrived. Estimated loss: $150. (S-69799.)

DECEMBER 23, 1934. GAS WORKS. BATH, MAINE. The butane gas equipment at this plant is automatic and unattended, but is inspected daily by an employee and checked by a watchman at night. On the night of the fire, the watchman reported an irregularity in the gas-fired water heater and the employee came to give it attention. Finding frost on the gas pipes from the exchanger and on the valve and meter, he realized that raw butane had passed through the exchanger and from lack of heat had not gasified but collected in liquid form in the pipes normally containing gas only. To remedy this, he removed the plugs in the gas piping and drained the butane into a pan. In some way, perhaps from a near-by gas-fired heater, the fumes ignited and a fire resulted, burning the employee superficially. Estimated property loss: $400. (H-39559.)

ABOUT 1935. RAILROAD PROPERTY. SPOKANE, WASHINGTON. In order to demonstrate the merits of a fire extinguisher, about a gallon of liquefied petroleum gas was withdrawn from the storage tank and poured into a flat garage drip pan. There was a delay in lighting the pan. Gas evaporated and spread for a distance of from 30 to 40 feet. A fire flared at once when a match was applied, and one man was burned. The obvious cause of the fire was carelessness and lack of knowledge of the characteristics of the product. (H-44061.)

ABOUT 1936. TUNNEL PROJECT. MONO BASIN, CALIFORNIA. To interconnect the piping on two 10,000-gallon horizontal tanks, it was necessary to remove several valves to make outlets face in the proper direction. Liquefied petroleum gas was transferred from one tank to the other by means of a temporary connection until there were only a few inches of liquid remaining in the first tank. It was then blown down from the vapor space until the gauge showed 0 pounds pressure. The mechanic removed a valve in a 1½-inch dip pipe and liquid butane came out of the opening. It flowed down a grade, was ignited by an operating water heater near by, and sent a flame back to the top of the empty tank. The ignition of the full tank soon followed, and the fire burned for several hours. At length the pressure was so relieved that it could be extinguished with wet sacks and the openings were closed. This accident was due to carelessness in having an open flame close by while working on a live tank and too much faith in a commercial pressure gauge. (H-44062.)

ABOUT 1936. SERVICE STATION. LOS ANGELES, CALIFORNIA. A liquefied petroleum gas tank truck was discharging into a receiving tank. The union connections had a slight leak and a lighted match ignited the escaping vapors. A fire flared up but was quickly extinguished. (H-44063.)

FEBRUARY 9, 1936. COLLEGE. SEGUIN, TEXAS. Live coals in a kitchen heater are believed to have ignited escaping butane gas. The gas installation had been faulty. Due to lack of fire protection and location outside the city limits, extensive damage was done, a four-story brick building being completely destroyed. No lives were lost, but the property damage was estimated at $60,000. (H-40133.)

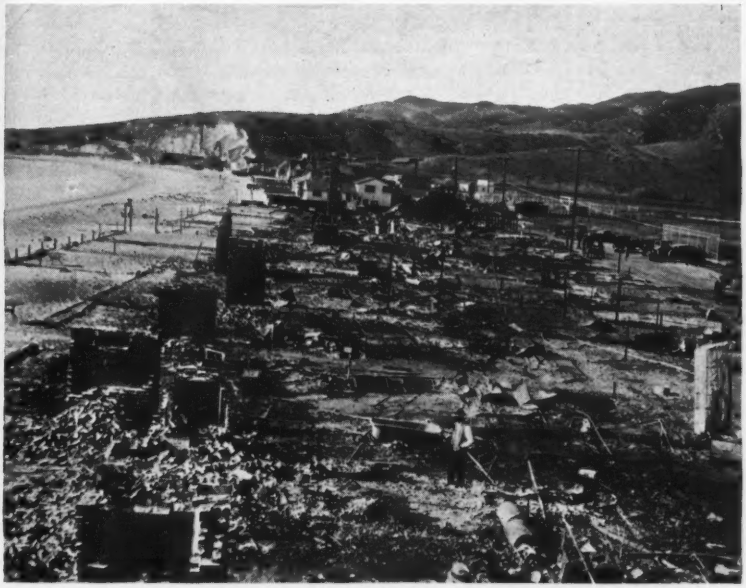
JUNE 6, 1936. MERCANTILE. TAMA, IOWA. Pentane gas, escaping from an improperly installed compressed gas system, was ignited. The resulting explosion killed three persons and injured twenty-two others, while destroying four buildings. (L-4451.)

OCTOBER 22, 1936. GASOLINE FILLING STATION. CROWLEY, LOUISIANA. A 1000-gallon skid tank, containing at the time some 600 gallons of butane, was being removed from its cradle on a wooden truck to a platform three inches higher. Careless employees broke the discharge connection and butane flowed out of the two-inch outlet, vaporizing immediately. A slight wind carried these vapors to a metal trash burner about 162 feet away. They ignited immediately and the fire flashed back to the tank and adjacent buildings. Four explosions were heard in succession and the fire spread rapidly. A warehouse, a frame mercantile building, a filling station, and several dwellings were totally destroyed. Five persons were burned to death. This accident might have been prevented if the tank on which the discharge connection was broken had had an excess-flow valve installed. (H-41441.)

DECEMBER 31, 1936. SHIPYARD. CHESTER, PENNSYLVANIA. In order to verify a gas leakage in a valve pit at some distance from a liquefied petroleum gas tank, two men lit a match and tossed it into the pit. In the resultant explosion and flash fire they were burned and died of their injuries. Sheer carelessness was the obvious cause here. (H-41510.)

APRIL 5, 1937. MERCANTILE. AUSTIN, TEXAS. Fifty gallons of butane gas had just been put into a 190-gallon steel tank. This tank was located on the floor of the building, in violation of all established regulations. These require that approved units, which this particular one was not, must be placed with the top of the tank at least two feet below ground and not less than ten feet from any building. Gas vapor escaped from the leaky filling hose and was ignited in some unknown way, possibly by a static spark. A small fire followed in which two men were slightly burned. (H-41768.)

MAY 2, 1938. METAL WORKER. DETROIT, MICHIGAN. A furnace used to draw spring steel bumper parts was being operated at a temperature of 960 degrees Fahrenheit, fired by butane gas. The pilot light failed, the electrode became grounded, and butane passed through the combustion chamber and flowed out of the charge end of the furnace. The gas was ignited by a high-heat furnace thirty feet away and an explosion followed, causing considerable damage but no loss of life. (H-42584.)



The spread of the fire which devastated the celebrated Malibu Beach, Calif., colony on December 15, 1930, was due in part to the explosion of liquefied petroleum gases that had been stored in non-standard containers near the origin of the blaze. The property loss ran to more than $250,000.

JULY 5, 1938. RESTAURANT. GEORGE WEST, TEXAS. An obsolete and improperly installed underground tank was located in an earth fill, without concrete pit, beneath the four-inch concrete floor of the restaurant's small storage room. The tank was not properly designed and was not equipped with safety devices such as relief valve, back-pressure and excess-flow valves. It was intended to be filled by the gravity flow method, using two connections between the supply tank and underground tank to equalize pressure. To speed the filling of the tank, the driver vented the underground tank to the outside air through the storage room, which adjoined and communicated with the kitchen, a very dangerous practice. The storage room also communicated through an open window with the dish washing room, where a water heater was in operation. The tank filled much more quickly than was expected, perhaps because of the high vapor pressure in the tank truck caused by several hours exposure in the hot sun. Liquid flowed from the vent and two explosions followed almost at once. Fire prevented closing of the valves. The source of ignition is not definitely known, but is assumed to have been one of the five lighted burners in the restaurant kitchen, all of which were within close range. The restaurant and a dwelling fifty feet away were completely destroyed. The local volunteer department, with outside aid and an ample water supply, limited the fire to these two buildings. Four persons were killed and twelve were injured. Loss: about $6700. (H-42499.)

SEPTEMBER 12, 1938. HAT FACTORY. BREESE, ILLINOIS. An explosion from an unknown cause occurred in the factory spray room, in which several driers were located. A fire soon followed and was fed by a pentane gas line above the room which was ruptured by the explosion. A 1½-inch sprinkler line was also broken, but seventy-six sprinkler heads operated and held the fire in check until the arrival of the fire department. One employee died as a result of burns received. The loss was between $60,000 and $75,000. (S-76390.)

OCTOBER 3, 1938. TANK TRUCK. SACRAMENTO, CALIFORNIA. A tank truck carrying butane gas was struck at a crossing by a train. The butane was released by the impact and ignited. Two bystanders were burned to death and the truck driver seriously injured by the flames. (H-42750.)

ABOUT 1939. TRUCK. SOUTH PASADENA, CALIFORNIA. A truck, carrying three small tanks of liquefied petroleum gas, sprang a leak in its own gasoline line. A fire followed and though two of the tanks were relieved by fuse plugs melting out, the third failed and exploded. The failure was due to the substitution of a leaky fuse plug for a solid plug, and to the overfilling of the container. (H-44064.)

1939. BUS TERMINAL. LONG BEACH, CALIFORNIA. A fire broke out under the hood of a bus operated by liquefied petroleum gas. The fire burned steadily until the valve at the supply tank was turned off. Damage was slight, but the importance of employees having complete knowledge of the tank design and operation, especially of the location of the shut-off valve, was clearly indicated. (H-44065.)

1939. TANK TRUCK. SOUTH OF BAKERSFIELD, CALIFORNIA. Gravity transfer was resorted to in fueling a fleet of trucks from a transport tank. To reduce the pressure and speed up the filling, the vent valve on the vehicle tank was opened. A lighted match caused a fire at the opening of this valve. Fuse plugs melted out and the flame covered the engine cab and hood. The truck was a total loss. (H-44067.)

JANUARY 2, 1939. CHEMICAL WORKS. NEWARK, N. J. Just as a butane system, which was on the same header as the steam connection in another department, had been cleared of condensate through pressure of gas, a violent explosion occurred. It is believed that some of the gas filtered through a pipe duct into a black ash kiln and was ignited. The gas, not dispelled by air circulation, seems to have collected in an open court near the pipe duct in considerable amount. Two employees were badly burned. Damage was estimated at $300. (S-76966.)

JANUARY 30, 1939. RESTAURANT. DEGRAFF, OHIO. A 500-gallon underground tank was being filled from butane cylinders carried by a standard service truck. During the operation a terrific explosion occurred, killing two men, injuring another, and doing extensive property damage. Examination revealed that the weld at one end of the tank had practically disappeared, leaving an opening about four inches in length through which gas had escaped. The cause of ignition was apparently a coal stove in the restaurant not far from the tank. Though the tank had passed factory inspection four years earlier, hard service had resulted in a deterioration of the joint from which the gas escaped. (H-44068.)

JUNE 13, 1939. RESTAURANT. BREWSTER, N. Y. As a liquefied petroleum gas system was being installed near the rear of a building, one of the tanks was dropped and a valve broken off. The escaping gas traveled to an adjoining building in which a restaurant was located, and apparently some of the gas collected in the kitchen and was ignited from the hot bricks in a power oil burner range after such burners and other gas burners in the kitchen had been turned off due to the exposure. Three persons were instantly killed and several others injured. The building in which the restaurant was located, together with the adjoining building, was destroyed. Loss: $25,000. Careless handling of liquefied petroleum gas near a source of ignition was the cause of this tragedy. (H-43555.)

JANUARY 21, 1940. HOSPITAL. HAMMOND, LOUISIANA. A tank truck had arrived to fill a 150-gallon butane supply tank which was buried behind the hospital in an open area. The heaters had been inoperative for three days, making it necessary to drain the system. As the union at the nearest heater was disconnected, liquid butane squirted as high as the ceiling, its vapors being ignited by two open grate fires in the vicinity. Three persons were injured and, due to lack of water, the building was destroyed. It is possible that the unusually low temperature (10 degrees) at the time of the explosion caused liquefaction of the butane gas on the low pressure side of the regulator toward the top of the tank. Total loss: $3000. (H-43873.)

MARCH 12, 1940. MERCANTILE. WESLACO, TEXAS. An inexperienced service man was handling a 25-gallon cylinder of butane in a salesroom where gas and cooking appliances were on display. Through accident, mistake, or ignorance the man unscrewed the cylinder valve assembly just enough to allow the pressure to blow it off and allow the gas to escape into the room. An open pilot flame on one of the demonstration ranges ignited the gas and an explosion and fire followed. Once again the careless handling of liquefied petroleum gas near an open flame was responsible. One person was killed and five were seriously injured. Property damage was reported as being $25,000. (H-43891.)

MAY 22, 1940. YACHT. MARBLEHEAD, MASSACHUSETTS. A very violent explosion wrecked a 50-foot cabin cruiser that was fueled by liquefied petroleum gas and operated by a replaceable, two-cylinder assembly of conventional design. One life was lost and damage to the boat and the shed in which it was housed amounted to $3000. Although the exact cause of the explosion is unknown, a search later showed one of the shut-off valves in the valve assembly to have been opened. (H-43984.)

JUNE 25, 1940. GAS WORKS. ADAMS COUNTY, COLORADO. As two 100-pound cylinders were being filled with propane gas, the flexible hose connection leading from the tank truck suddenly broke and flooded the adjacent building with gas. The open flame of a gas-fired, household refrigerator that was being used for demonstration purposes in a room close by ignited the gas and an explosion resulted, followed by fire. Five persons were injured. Property loss: $11,700. (H-43991.)

JULY 24, 1940. RESORT HOTEL. BENTON HARBOR, MICHIGAN. A butane supply tank of about 500-gallon capacity was buried underground outside the hotel dining hall. The installation was approximately three years old and

seems not to have been of an approved type. As the tank was being filled from a smaller container, a light, explosive sound was heard, followed thirty seconds later by a violent one in the underground tank. It is possible that gas, escaping during the filling because of poor connections, found its way into the hotel basement and was ignited by the coal-fired water heater. The second explosion was followed by a fire that killed three persons, injured six, and destroyed three buildings. No loss estimate was given. (H-43919.)

JUNE 11, 1941. TANK TRUCK. LOS ANGELES, CALIFORNIA. A 2300-gallon tank truck trailer was being used as a butane storage supply for a road-grading job. All openings on the tank were in the head with the exception of the relief openings, a fusible element having been substituted for relief purposes. The tank was not equipped with excess-flow valves. The truck was located at the top of an incline, and butane was being transferred to one of several storage tanks by means of apparatus operated from the transmission of the vehicle. Although the brakes were set and a chock block placed beneath one rear wheel, the truck suddenly began rolling downhill, shearing completely the filling and vapor return hoses. The vehicle coasted approximately 150 feet and collided with a large road scraper. Butane was released over a wide area and ignited by an acetylene torch in use near by. The resulting fire was fed by the contents of a large gasoline storage tank, a diesel fuel tank, and a number of lubricating oil drums that were located a few yards distant. All were above ground. Fire emanated from the butane storage tanks, but no effort was made to extinguish it. Had the tanks been equipped with excess flow valves such a large amount of butane (approximately 4000 gallons) could not have been dissipated, and consequently the fire would have been of short duration. Several men were badly burned, though the fire department handled the situation very ably. (H-44059.)

OCTOBER 16, 1941. TANK TRUCK. COVINGTON, LOUISIANA. A tank truck was being filled from a storage tank, a centrifugal pump being use to hasten the operation. The engine carburetor was not equipped with a flame arrestor, and though the equalizer hose was connected to the top of the truck the end intended for connection to the tank was left on the ground. The escaping vapor was ignited, according to the truck driver, by a back fire at the carburetor, but it might have been done at the engine magneto contacts or at the exhaust. A flash fire followed and burned two persons. Carelessness on the part of the driver, use of substandard pumping equipment, and haste were the reasons for the accident.

National Magnesium Corporation Explosion.

Report by Schedule Rating Office of New Jersey.

At 12:35 P.M. on October 16, 1941, an explosion and fire occurred in the plant of the National Magnesium Corporation in Newark, N. J. This concern was playing a rôle of vital importance in the nation's wartime production effort, since it was engaged in the production of metallic magnesium powder for use in parachute flares, tracer bullets, and incendiary bombs. It was one of the few plants, if not the only one, capable of producing powdered magnesium of the desired degree of fineness for these purposes. It was completely wrecked by the explosion.

The manufacturing building was of irregular rectangular shape, approximately 57 by 122-160 feet over all and 14-22 feet high. It was divided into approximately equal sections by an 8-inch cement block partition wall with single automatic fire doors at all openings, except for one unprotected hot-air heating duct. The building was of unprotected skeleton steel construction, with 8- to 12-inch, brick-faced, tile curtain walls. The roof was of 3-inch reinforced concrete slab, while the floor was of concrete on earth, covered with a 1-inch top finish of asphalt to provide a non-sparking surface. A one-story dust collector house adjoined the manufacturing building at the rear and communicated with it through the metal ducts of the dust collection system. This house was constructed of cement block walls with a metal lath and plaster sheathed board joist roof and spark-proof floor. A slightly detached one-story building of frame, iron-clad construction was not involved in the explosion or fire.

The process employed at the plant involved the mechanical reduction of magnesium alloy to a powdered form of 100 to 200 mesh fineness. In order to reduce the amount of exposure of the material to the oxidation of the air, and by this means assure a low percentage of impurity, the operations of cutting, hammer milling, and sifting were all compactly located within the single west section area, while the dust collector house was closely adjacent just outside.

Briefly, the process of disintegration consisted of reducing 2-pound sticks of magnesium to fine chips or flakes in special milling machines. The stock passed by blower system through a metal flake bin and a high speed hammer mill to a Hummer type motorless sifter where it was separated into fine and coarse grades, that of sufficient fineness being taken off and collected in 20-gallon-size metal drums, the coarse material being discharged for recirculation through the system. The exceedingly fine waste dust which inevitably forms in this type of process was taken off by blower system and discharged into an ordinary cloth stocking type collector in the adjoining dust house.

This view of the west section of the plant of the National Magnesium Corporation in Newark, N. J., was taken shortly before the explosion and fire of October 16, 1941, which brought death to three persons and completely wrecked the structure. Shown above are the manufacturing building and, connected with it by dust collection ducts, the dust collection house.

Considerable effort had been made in the course of developing this process to safeguard it against fire and explosion. Both the frame of the building and all portions of the equipment had been grounded against the accumulation of static charges; all electric light and power equipment was of standard explosion-proof type; the employees all wore special non-sparking shoes and clothing; repairs and adjustments were made, it is claimed, only when the system was shut down, using non-sparking tools as far as possible; housekeeping, especially in the manufacturing areas of the plant, was excellent. Although employees had been instructed in the hazards of the process, and smoking strictly prohibited, the plant was without a private fire brigade and was without benefit of watchman service from 10 P.M. to 8 A.M.

On October 16, 1941, the day of the explosion, manufacturing operations were shut down to permit the substitution of an oil immersion type dust collector for the cloth stocking type then in use. As a result, the 15 regular employees were fortunately out of the building at the time of the accident. The men involved in making the change were breaking the duct connections to the old collector and setting up new ones when, according to one of the company officials at the opposite end of the building, three violent explosions took place in very rapid succession. There seems to be no doubt that the primary explosion occurred in the collector house, resulting in subsequent explosions in the main building. Their force demolished the dust house, tore away the west

The west section of the manufacturing building after the explosion had shattered it almost completely. The fire which followed did comparatively little damage and was brought quickly under control. The brick, concrete-block, and steel frame construction of the plant are clearly revealed in this picture.

wall and the west half of the south wall, and collapsed a good portion of the roof. The two men at the source of the explosion were killed outright, and the plant porter, who apparently ran out of the building into the blast, later died of injuries. The fire which followed the explosion caused comparatively little damage, being confined to a wooden fence on the west, the timber framework supporting the sifter, and what stock there was in the system. The latter was allowed to burn itself out, and the other fires were extinguished by the Newark Fire Department with the use of chemicals.

The cause of the explosion, the violence of which was a surprise to many, has not been definitely determined, as those directly concerned lost their lives. Many possibilities were considered, including ignition by a spark from a passing locomotive or from a foundry stack located about 300 feet distant. Inasmuch as the plant was located in a fairly open section of the city, these possibilities were termed too remote under the circumstances. Smoking by the workers was discounted, as they were said to have been well aware of the hazardous nature of the material.

The consensus of opinions among those making investigations of the explosion, including the officials of the concern, is that ignition was caused by a spark from the ordinary steel tools used by the workmen, or by a spark from a static electrical charge accumulated on the disconnected and therefore ungrounded, blower system ducts or on the bodies of the workmen. Due to the closely coupled nature of the system, the explosion in the dust collector was, of

course, rapidly communicated to the remainder of the system, with the destruction noted. A fact of interest is present in that, whether due to the force of the explosion or to fire heat, the containers of G-1 powder mounted on the flake bin opened and functioned properly in flooding the bin, the hammer mill, and near-by portions of the system with the powder, extinguishing the fire in the residues which must have been present. Fire in the timber framework of the sifter probably was caused by ignition of magnesium powder scattered on it by the explosion. In the absence of any fire of account, functioning of the fire doors was not a factor.

The destruction of this plant must be considered a definite blow to America's war-time production for, although it has been possible to sub-contract for the manufacture of some of the coarser grades of this material, the much-needed fine material will probably have to await the reconstruction of the plant in a new location. At present, the time necessary for resumption of operations is not known.

Riverview Convalescent Home Fire.

A fire which seems to have had its start in the careless disposal of a lighted pipe claimed the lives of eight elderly patients at the Riverview Convalescent Home in Rotterdam, New York, on the morning of December 16, 1941.

The Riverview Home, prior to its conversion into a retreat for convalescents, had been known for many years as the O'Loughlin Hotel. It had been constructed on the site of an earlier hotel, also destroyed by flames, and during 1936 it was damaged extensively by fire on two different occasions. The building was of wooden frame construction with joisted floors and roof. Although the owner claimed that it had been insulated with "fire-resistant materials throughout," it proved to be without adequate fire protection of any kind. Proper cut-offs were lacking, it was without automatic sprinklers, and there were no hydrants in the vicinity.

The blaze began at about 8 A.M. in a patient's room at the rear of the second floor of the home. Suddenly aware, after he had thoughtlessly laid his pipe down, that the curtains of his room were ablaze, the patient rushed into the hall and summoned the staff by his shouts. For several minutes the nurses in attendance tried to check the flames by throwing pails of water on them, but without success. The fire department was then sent for, but by the time it arrived the flames were billowing from every window and through the roof and had progressed beyond the point where ladder rescues could be effected. The nurses, with the help of several neighbors, had managed to lead and carry seven of the patients to safety, but the eight remaining perished before help could reach them.

Eight elderly persons, five of them women, perished in this unprotected frame building, the Riverview Sanitarium in Rotterdam, New York, when flames swept through it with devastating speed on the morning of December 16, 1941. The isolated location of the home, its flimsy construction, and its almost total lack of fire protection were invitations to disaster.

Both volunteer and paid city firemen responded to the telephone alarm. The Hoffman fire company, the Pattersonville volunteers, and the Rotterdam Junction department answered quickly, and the city of Schenectady sent three pieces of apparatus to the scene. The fire fighters were forced to break through the ice on the old Erie Canal near by and to take suction from it. Within an hour the fire was under control, but the home was by then a total loss. All of the institution's records were destroyed, as well as the personal property of the patients and staff.

It is significant that all of the patients who perished in the flames were bed-ridden. Their average age was 78 years. That a convalescent home of this type, of unsprinklered frame construction and almost completely lacking in any kind of public or private fire protection, should have been permitted to exist is unfortunate to say the least. The fire fighting and rescue attempts made by the staff were commendable, but were doomed to failure under such circumstances, as was the saving of the home itself.

The Amityville Sanitarium Fire.

Shortly after midnight, on November 18, 1941, death by fire came to seven persons—four men and three women—in the little town of Amityville on the south shore of Long Island, New York.

The scene of the fire was the Brunswick Home, a sanitarium established in 1887 for the care of those suffering from chronic ailments. The home included several buildings, the largest of which was the administration unit, a four-story frame and stucco structure in which a number of elderly patients were housed. The fire risk inherent in the building's construction—in its wooden framework, open stairwells, combustible roof, and absence of any fire walls or fire doors—was heightened by the obvious lack of preparedness on the part of the sanitarium staff. Little knowledge of the hand extinguishers available for use was displayed when most needed, and had fire drills been a regular practice in the home the loss of life which was to follow might have been materially lessened.

Just a few minutes after twelve o'clock midnight, as one of the sanitarium's cooks was preparing to serve a meal to the employees on the late shift, a pan of grease on the kitchen stove became ignited in some way and flared up quickly. As the cook fled in haste, the fire spread to the floor and walls and swept in a mushroom movement toward the roof. The night watchman and some passers-by telephoned the fire department promptly, but though the apparatus arrived within a very short time the blaze in the administration unit was beyond control.

Heroic rescue efforts were made by firemen, police, and townspeople, and more than thirty aged and infirm patients were carried from the sanitarium to safety, some by way of the fire escape leading from each floor of the building, a means of egress for the patients which a well-trained force of attendants might earlier have put to successful use. The intense heat and the continual danger from falling walls and timbers defied all attempts at rescue of the seven invalids remaining. The bodies of six were not recovered until the following day, and the seventh, an attendant at the home, died later of injuries sustained in jumping from the third floor.

Fire-fighting activities were confined to wetting down the surrounding buildings, so that the flames were restricted to the structure in which they started. The volunteer fire department of Amityville was congratulated by all observers upon the efficient way in which it handled a difficult assignment. It received help from the neighboring departments of North Amityville, Copiague, and Lindenhurst, and, in the rescue phases of the tragedy, from various local emergency units. The prompt and effective aid rendered by the Red Cross

International.

Volunteer firemen of the Amityville, Long Island, department are shown in action against the flames that brought death to seven persons in the Brunswick Home. Had the attendants in the home been properly trained in the use of the fire escape at the right of the picture, the loss of life among the aged patients might have been materially lessened.

motor and medical corps, by an organized group of housewives, and by a crew from the Long Island Lighting Company proved invaluable. An exhibition of coöperation by auxiliary forces such as these is particularly significant and encouraging in this time of national emergency.

The elimination of fire hazards in those classes of buildings occupied by the sick and the aged should have the very strongest appeal to those in authority. Responsibility for those disabled, who because of their condition cannot quickly seek safety in event of fire, rests inevitably with those into whose care they have been entrusted. Unfamiliarity on the part of attendants with elementary fire protection equipment, the absence of fire drills of any kind, and the failure of administrators to install adequate sprinkler protection in combustible structures are nothing more than invitations to disaster.

Fires in Which There Was Loss of Life.

Fourth Quarter, 1941.

During the past three months the Department of Fire Record has received reports of seventy-five fatal fires resulting in the loss of two hundred and thirty lives. Summarized below are the only fires which, according to our records, cost five or more lives each during the period from September to December.

OCTOBER 26, 1941, CLANTON, ALA. Seventeen persons were burned to death when a large passenger transport bus took fire after striking the guard rail of a narrow bridge. (L-06568.)

OCTOBER 27, 1941, DANIEL BOONE, KY. Fifteen miners were trapped and asphyxiated in a coal mine following an explosion. Cause of the explosion was not immediately determined, but gas is known to have been present. (L-06569.)

OCTOBER 28, 1941, MONTCLAIR, N. J. Twelve negroes, ten children and two women, were burned to death when fire destroyed their three-story, two-family frame home. The fire started when two men accidentally dropped a lighted kerosene heater, showering the first floor living room and hallway with burning oil. In addition to those who died, eight others were injured or burned in making their escape from the building. (L-06570.)

OCTOBER 31, 1941, ST. THOMAS, ONT. Nineteen men and a woman died when a large airliner crashed in a field and immediately burst into flames. (L-06571.)

OCTOBER 31, 1941, MOORHEAD, MINN. Twelve men and two women were burned to death when the airliner in which they were traveling crashed and burst into flames. The pilot of the plane was thrown clear of the wreck, but was unable to release the others who were trapped inside. (L-06572.)

NOVEMBER 14, 1941, MISSOULA, MONT. Five children ranging in age from nine years to five months were burned to death when fire swept through their home while their mother was across the street caring for an invalid neighbor. (L-06573.)

NOVEMBER 15, 1941, RANGER, TEX. Eight men were fatally burned while watching two trucks burn following a collision. A large truck laden with lumber broke down on a hill and the driver posted safety flares along the highway to warn approaching vehicles. A smaller truck, however, collided with the rear of the stalled truck, puncturing the gasoline tank. Gasoline, running downhill from the tank, was ignited by one of the flares and this ignited the trucks and cargoes. About a score of persons gathered to watch the fire. After some twenty minutes the fire reached the reserve tank on the lumber truck which contained about thirty-five gallons of gasoline. The tank burst and sprayed the spectators with the burning liquid. (L-06574.)

NOVEMBER 15, 1941, RUSHVILLE, IND. Nine lives were lost, including three women and two infants, when a large passenger bus plunged down an embankment after a collision with another car, and burst into flames. All but one of the victims were burned beyond recognition. Several passengers were able to escape through the rear of the bus which was broken open by the crash. (L-06575.)

NOVEMBER 18, 1941, AMITYVILLE, N. Y. Three men and three women were trapped and burned to death when fire destroyed part of a private hospital. (For full report of this fire, see page 284.) (H-44091.)

NOVEMBER 19, 1941, VAN NUYS, CALIF. Trapped in a 7000-foot railroad tunnel, five men died when a freight locomotive burst into flames, filling the tunnel with smoke and fire. Five other men managed to make their way out of the tunnel. The fire occurred when a coupling snapped on the ninety-six-car train, automatically setting the brakes. The oil line between the locomotive and tender was broken and burning oil sprayed over a small area of the tunnel. Intense heat and smoke, which made available gas masks ineffective, choked off rescue attempts. In addition to the loss of human life, some three hundred head of cattle also perished. (L-06576.)

DECEMBER 1, 1941, OKMULGEE, OKLA. A series of explosions at an oil refinery killed five men and injured fifteen others. The cause of the six explosions which involved three 250-barrel tanks of gasoline and three others of 450-gallon capacity, has not been established. Four of the victims died in a vain attempt to rescue one of their fellow workers. (H-44092.)

DECEMBER 12, 1941, BURLINGTON, IOWA. An explosion which virtually demolished a T.N.T. melting unit in a huge government ordnance plant, killed nine workmen and injured at least twenty-one others. Reports indicate that the explosion occurred in a three-story structure where T.N.T. was melted by steam for blending with other explosives. The cause of the explosion, if known, was not reported. (L-06577.)

Typical Fatal Fires.

Children Alone in House.

OCTOBER 19, 1941, KITTERY, ME. Two small boys were suffocated when a fire of unknown origin swept through their home. Their parents had gone out on an errand, leaving the children sleeping, and the fire occurred while they were away. (L-06579.)

DECEMBER 1, 1941, SKOWHEGAN, ME. Three children, the eldest three years of age, perished in a fire which destroyed their home. The fire, believed to have been caused by a faulty stove pipe, broke out while their father was at work and their mother was at a neighbor's home. Five other children in the family were not at home when the fire occurred. (L-06578.)

DECEMBER 9, 1941, HAMMONDS PLAINS, N. S. While their mother watched helplessly, two infants were burned to death in their country home. At the time, the father was at his work and the mother of the children had gone next door to collect her mail. Cause of the fire, which reduced the home to ashes, was not reported. (L-06580.)

Clothing Ignited.

OCTOBER 9, 1941, JERSEY CITY, N. J. An elderly woman was fatally burned when her clothing was ignited by a pile of leaves she was burning in the yard of her home. (L-06581.)

NOVEMBER 24, 1941, TENAFLY, N. J. A woman died in the hospital of burns suffered when her clothing was ignited by a gas heater as she sat reading in her home. (L-06582.)

Entering Burning Buildings.

OCTOBER 26, 1941, ERIE, PA. A young waitress lost her life when she rushed into a burning restaurant in an effort to save her coat and purse. Sev-

eral others did likewise but escaped uninjured or with minor cuts and burns. (L-06583.)

OCTOBER 30, 1941, BOUCHERVILLE, P. Q. An elderly woman was trapped and burned to death when she dashed back into her burning home to save documents and other valuables. The fire occurred in the early morning and is believed to have spread from the kitchen stove. (L-06584.)

Escaping Fire.

SEPTEMBER 27, 1941, VAL MORIN, P. Q. A woman died of fractures and internal injuries received when flames broke her hold on a rope down which she was attempting to escape from a burning resort hotel. The victim, who weighed in the vicinity of 250 pounds, was the cook for the establishment, which was closed between seasons. At the window of each room in the three-story structure was a heavy rope with knots spaced every foot, furnished for escape purposes. It was down one of these lines from a third floor window that the cook tried to descend. It is believed that flames lashed at her through the second-story windows, causing her to lose her grip and fall to the ground. (H-44090.)

NOVEMBER 27, 1941, BROOKLYN, N. Y. A young man was killed when he jumped from a second-story window to the street in an attempt to escape from fire which swept through his apartment. His father and a brother were seriously burned, while three others escaped uninjured. Cause of the fire, which started in the dining room, is not reported. (L-06585.)

Explosions.

OCTOBER 16, 1941, NEWARK, N. J. Three men were killed by a magnesium dust explosion which seriously damaged a plant engaged in the grinding of magnesium. The explosion occurred in the dust vault while operations were shut down to permit replacement of the dry type dust collecting system with one of the oil-wash type. Two tinsmiths were on the roof making the necessary alterations in the pipes when the explosion took place. One was killed instantly, the other dying shortly afterward. Two plant employees in the grinding room were also badly injured, one of them dying the following day. The cause of the explosion has not been definitely established, but it has been suggested that it may have been due to carelessness of the tinsmiths or to a spark from a locomotive on adjacent railroad tracks. (H-44089.)

Flammable Liquids and Gases.

SEPTEMBER 13, 1941, NIAGARA FALLS, N. Y. A man died of burns suffered when gasoline, with which he was cleaning machinery, became ignited. (L-06586.)

OCTOBER 28, 1941, ESTCOURT, P. Q. A man and his two children were burned fatally in their rural home when the father mistook a can of gasoline for kerosene and used some to kindle a fire in the kitchen stove. His clothes caught fire and his wife followed him outdoors, where she extinguished the flames with a blanket. By the time this was done, however, a wall of fire prevented them from reentering the house and the two small children were burned to death in their beds. (L-06587.)

NOVEMBER 7, 1941, YONKERS, N. Y. A hospital patient died after being severely burned when the oxygen tent under which he was being treated caught fire. Cigarettes were found in his room, and although he had been warned not to do so, it is believed that he had attempted to smoke. (H-44088.)

NOVEMBER 9, 1941, STE. AGATHE, P. Q. A woman was fatally burned when a can of kerosene exploded in the kitchen of her home and set fire to her clothes. It is believed that after using some of the kerosene to kindle a fire in the stove, she set the can on the edge of the stove and continued her work. The explosion occurred a short time later, shattering most of the windows in the house and igniting her clothes. (L-06588.)

Smoking in Bed.

SEPTEMBER 21, 1941, SANTA ANA, CALIF. A woman died in the hospital the day after she suffered severe burns by falling asleep in bed with a lighted cigarette. (L-06589.)

OCTOBER 30, 1941, MONTCLAIR, N. J. An elderly man and his wife lost their lives in a fire which swept through the upper floor of their home. Investigators reported that the woman had apparently fallen asleep while smoking in bed, setting fire to the bedclothes. Awakened by the fire, she had fallen down stairs while trying to escape the flames. Her husband, in another bedroom, awakened by the smoke or by her screams managed to pick up the telephone and give the alarm before he too collapsed. (L-06590.)

DECEMBER 13, 1941, WASHINGTON, D. C. A woman died of burns suffered when she fell asleep while smoking on a divan. The divan and her clothing became ignited. (L-06591.)

Loss of Life Fires, September-December, 1941.*

This is a typical rather than a complete record, presented to show the conditions under which loss of life occurs, that they may be known and guarded aaginst. The total loss of life by fire in the United States is estimated at 10,000 annually.

Occupancy	No. Fires	Men	Women	Children	Total
Aircraft	2	31	3	0	34
Apartments, Hotels, Lodgings, Tenements, etc.	10	10	5	1	16
Boats and Ships (except Tank Vessels)	1	1	0	0	1
Churches and Church Property	1	0	1	0	1
Dwellings—rural	8	2	2	12	16
Dwellings—urban	19	7	15	21	43
Dwellings—trailers	1	1	0	0	1
Hospitals and Institutions	2	5	3	0	8
Manufacturing Occupancies	6	12	0	0	12
Mercantile Occupancies	2	2	2	0	4
Mining Property	2	19	0	0	19
Motor Vehicles (except Tank Trucks)	6	31	7	3	41
Munitions plants	2	13	0	0	13
Oil Refineries and Bulk Distributing Plants	2	6	0	0	6
Out of Door Fires	5	3	1	1	5
Railroad Rolling Stock	2	6	0	0	6
Response to Alarms	2	2	0	0	2
Restaurants	1	0	1	0	1
Other Known Buildings	1	1	0	0	1
Total	75	152	40	38	230

*This table is made up from those reports received by the Department of Fire Record between September 16, 1941, and December 15, 1941. A few of the fires included herein occurred prior to September 16, but were not reported until subsequent to that date.

Trapped in Burning Buildings.

NOVEMBER 6, 1941, ALEXANDRIA, VA. Four men lost their lives in a fire which swept through the Monticello Hotel during the early morning hours. Three of the victims were found suffocated on the third floor of the four-story brick structure, while the fourth was dead upon arrival at the hospital. The fire was discovered by the night clerk and is believed to have originated in a closet under the stairs leading from the third to the fourth floor. Spontaneous ignition of oily rags or similar material is advanced as the cause of the fire. When the fire department arrived, the guests on the upper floors were hanging out of the windows, calling for help. The lone fire escape was an outside steel affair located on a side of the building access to which was cut off by the fire. Exit by the open stairs was impossible. Numerous rescues were made by the fire department, one of the guests being taken from a neon sign to which he had climbed to escape the heat. Of the forty rooms of the hotel, thirty-nine were occupied at the time of the fire. (H-44087.)

Causes of Loss of Life, October-December, 1941.

Fatalities classified according to the immediate cause of the loss of life rather than according to the cause of the fire.

Cause of Fatality	Men	Women	Children	Total
Aircraft Fires	31	3	0	34
Asphyxiation (Smoke and Gas Suffocation)	1	3	2	6
Children Alone in House	0	0	14	14
Children Playing with Matches	0	0	1	1
Clothing Ignited:				
1. Bonfires, Burning Rubbish, etc	1	1	0	2
2. Furnaces, Stoves, and Heaters	0	3	0	3
3. Smoking in Bed	3	4	0	7
Entering a Burning Building	4	2	1	7
Escaping fire; jumped, fell or drowned	3	1	0	4
Explosions:				
1. Chemicals	3	0	0	3
2. Explosives	13	0	0	13
3. Manufactured and Natural Gases	0	4	0	4
4. Miscellaneous and Unknown	4	0	0	4
Fire Fighting—Firemen	3	0	0	3
Flammable Liquids and Vapors:				
1. Gasoline and Similar Liquids:				
(*a*) Stoves, Lamps, and Torches	1	1	0	2
(*b*) Used for Cleaning Purposes	3	0	0	3
(*c*) Used to Kindle Fire	1	1	2	4
2. Kerosene, Range Oil, and Fuel Oil:				
(*a*) Stoves, Lamps, and Torches	0	0	1	1
Indirect Causes (over-exertion, exposure, etc.)	1	0	0	1
Marine Fires	1	0	0	1
Mine Fires and Explosions	19	0	0	19
Motor Vehicle Fires (except Tank Trucks)	31	7	3	41
Railroad Rolling Stock Fires	6	0	0	6
Response to Alarms	2	0	0	2
Trapped in Burning Buildings	20	10	14	44
Miscellaneous Known Causes	1	0	0	1
Total	152	40	38	230

Arson is a favorite weapon of the saboteur ...and the automatic sprinkler his deadly enemy. The arsonist's first move, therefore, is to shut off the supply of water to the sprinkler system, or otherwise to render it ineffective. And this he can easily do—unless the sprinkler system is electrically supervised to automatically detect and report such tampering.

A.D.T. Supervision is the most effective safeguard to insure that sprinkler systems are constantly maintained in proper operating condition. The closing of any shut-off valve or any other condition that might impair the sprinkler's effectiveness, whether by accident or malicious intent, is instantly and automatically reported to the Central Station, which immediately investigates every trouble signal and secures corrective action. A.D.T. Supervision makes the sprinkler system function also as an efficient automatic fire alarm system, automatically summoning the fire department the instant a sprinkler head opens.

Write for further information on this and other A.D.T. Electric Protection Services that are helping establishments in all fields to combat the threats of sabotage, fire and burglary.

These Services include *Sprinkler Supervisory and Waterflow Alarm, described here; Aero Automatic Fire Alarm; Invisible Ray Alarm; Holdup Alarms; Burglar Alarms; Emergency Police Call; Watchman Supervision. Descriptive booklets furnished on request.*

A. D. T. SPRINKLER SUPERVISORY AND WATERFLOW ALARM SERVICE

Controlled Companies of **AMERICAN DISTRICT TELEGRAPH CO.** *155 Sixth Ave., New York*

CENTRAL STATION OFFICES IN ALL PRINCIPAL CITIES OF THE U.S.

A·D·T *Electric Protection Services*
AGAINST FIRE · BURGLARY · HOLDUP
A NATION-WIDE ORGANIZATION

Your copy of this Deluge System bulletin will be sent on request.

VIKING HANGAR DELUGE SYSTEM

. . . Automatically deluges water from combination of open overhead and open floor sprinklers when room temperature rises suddenly or room temperature rises to a predetermined fixed temperature.

The TYDEN self-setting control valve employed in the VIKING Deluge System is the **only** automatic deluge valve that resets itself after operation . . . To put the system in operative condition following flooding it is only necessary to shut off main water supply, drain water from the system and raise small handle of the relief valve. Then close drain valves, again open water supply valve and the system is ready for operation . . . Write VIKING CORP. for full details regarding installation and maintenance of Viking Hangar Deluge System.

Representatives in Principal Cities

THE VIKING CORPORATION

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Waterspheres like the one shown at the left have been built extensively during the past few years for use in municipal water systems. The one shown, however, is the first installation to be used at an industrial plant. It was recently installed for the Harding Glass Company at Ft. Smith Ark., has a capacity of 100,000 gals., and is 65 ft. to bottom. It provides gravity water pressure for general service at the plant.

The Watersphere is an elevated water tank in its simplest form. There are only three elements in the structure, the pedestal having replaced the structural tower normally used on elevated tanks. It is a beautiful, clean-cut structure, and because of its smooth surfaces, is economical to maintain.

Because its modern, interesting lines attract favorable attention, it may be made an asset, too, as an advertising feature.

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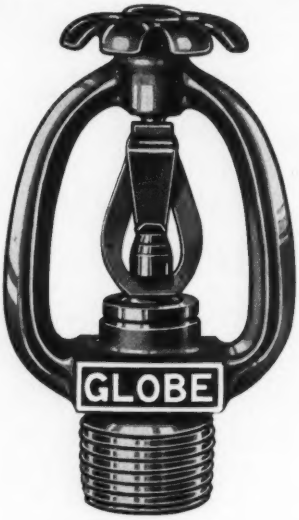

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Fires, from whatever cause, interrupt schedules, delay deliveries, and reduce the output of skilled workers.

It is just as important to keep these producing ranks behind the line closed as it is to keep the fighting ranks at the front.

It takes at least five skilled workers at home for every man in the armed forces.

Defense Must Come Fast — Fire Safety Must Keep Pace With It

The Complete line of time-tested and approved

GLOBE AUTOMATIC SPRINKLER EQUIPMENTS

provide all-out protection in buildings, adequate and unaided, to battle fires from whatever source — Bombing, Sabotage, Industrial Hazards or Accidents.

Protection Is Preparedness

GLOBE AUTOMATIC SPRINKLER COMPANY

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VALVES
HYDRANTS

AND PIPE LINE ACCESSORIES

M & H products are well known for high quality material and expert workmanship. They have been widely used throughout the country for many years. They include several types of Gate Valves, Check Valves, Flap Valves, Valve Boxes, B & S Fittings, Flanged Fittings, Fire Hydrants and many other cast iron pipe line accessories.

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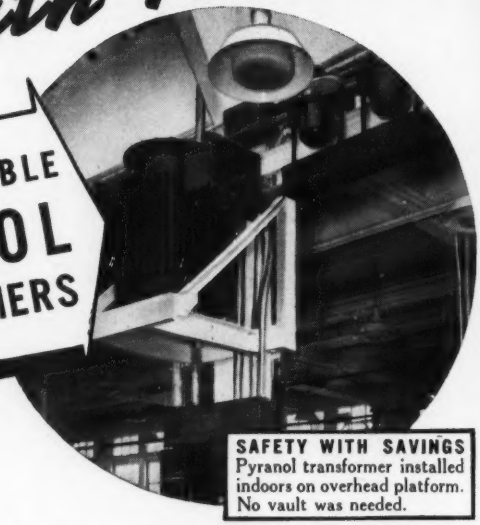

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Pyranol transformer installed indoors on overhead platform. No vault was needed.

FIREFIGHTERS feel a lot more friendly toward transformers filled with Pyranol—General Electric's noninflammable synthetic cooling liquid for electric equipment. They know these transformers can't add to fire hazards—even if their tanks are ruptured—because PYRANOL CAN'T BURN!

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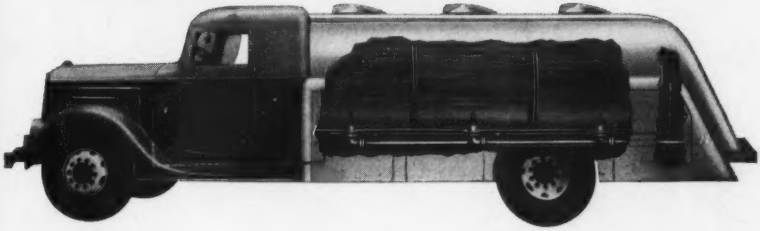

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This is one of four different types of S. & J. Internal Safety Valves, available in sizes from 1½ to 6 inches.

The exigencies of this war emphasize the great importance of getting petroleum from the points where it is produced and refined to the places where it is urgently needed. With a scarcity of tankers and a congestion in rail transportation, a heavy burden falls upon truck transportation. We can't afford to lose any gasoline, equipment, or sustain any property loss due to any unnecessary fires. S. & J. Hydraulic Safety Valves make truck transportation of petroleum safe. Insist that every truck tank under your jurisdiction be so equipped.

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140-F SAFETY DRY CLEANING

It's a record to be proud of—the clear loss record made by the Hoffman 140-F drycleaning system, in hundreds of installations during the past six years! The point is—this is Petroleum Solvent Equipment—not a chlorinated solvent unit! It's the original Safety Petroleum Solvent Unit—an exclusive U. S. Hoffman development to promote greater safety in the drycleaning industry. An approved Class II system, the 140-F complies with standards of National Board of Fire Underwriters Pamphlet No. 32. Most inspection departments permit installation without enclosing walls.

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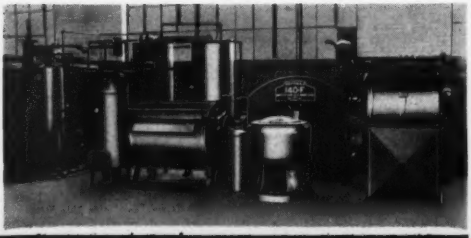
The Hoffman 140-F drycleaning system employs safety solvent with flash-point of approximately 140° F. The system is offered to the drycleaning industry in 12 different types—each one tested and listed by the Underwriters' Laboratories Re-examination Service.



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Suprotex detects the first sign of fire in advance of sprinkler operation, sounds an alarm calling for manual extinguishment, and rushes water to the sprinklers. Here it is held until the fire becomes hot enough to open the sprinklers. Prompt action by the employees in a number of fires has enabled them to extinguish the fire manually — before the sprinklers open — thus saving water damage. If no one answers the fire alarm, the sprinklers will open and extinguish the fire.

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Back of each Suprotex installation stands over fifty years of experience in the automatic extinguishment of fire, and *there are no priorities on that engineering experience and skill.*

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Specially Prepared PITCH

PROTECT YOUR PLANT

Keep Production Up

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Our pitch meets all specifications for use as a fire fighter.

A new, efficient, and economical protection for extinguishing fires from metal shavings — (magnesium, aluminum, etc.)

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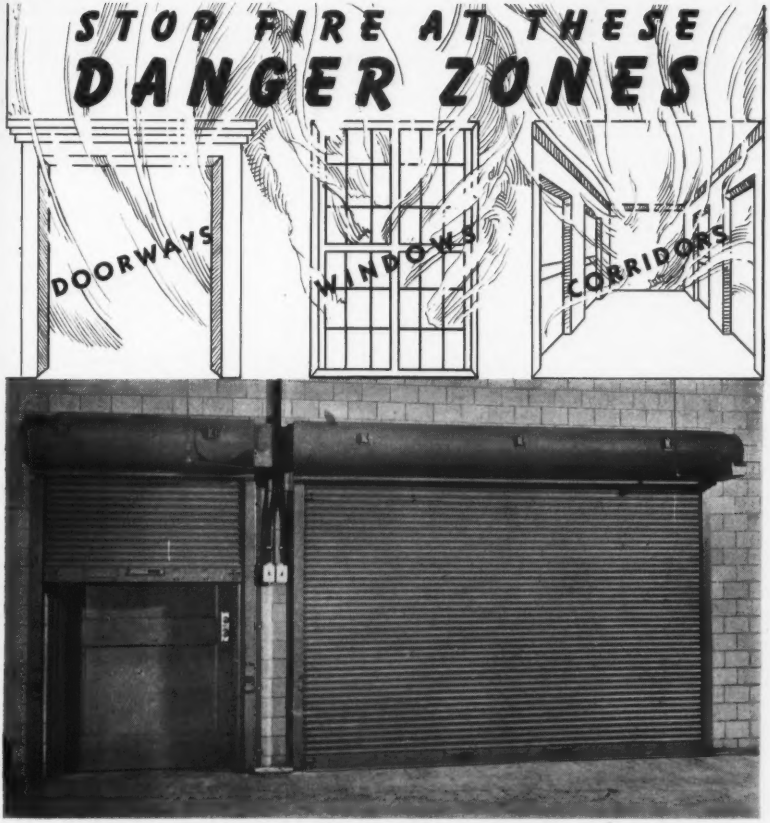

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NATIONAL FIRE PROTECTION ASSOCIATION

60 BATTERYMARCH STREET

BOSTON, MASS.

★★
FINAL STOCKS
EVENING
PHILADELPHIA, THURSDAY, AUGUST 21, 1941
VOL. CCXI, NO. 139
16 FELLED BY POISON SMOKE
Priest Saves Fireman As 3-Alarm Blaze Hits West Phila. School
Nuns Give Warning; Spontaneous Combustion Blamed
Sixteen firemen were overcome by dense acrid smoke as a three-alarm fire swept the basement of the school of the Church of the Transfiguration, Cedar Ave. between 55th and 56th Sts. at 3 P. M. this afternoon.
The fumes as instantaneous in effect as a poison gas attack, failed the firemen as soon as they entered the building. The deadly nature of the smoke apparently was caused by chemicals with which some tents in the basement had been treated.
The fire started in the way and the basement, according to
"There was considerable camping equipment including tents, stored in the basement," he said. "These tents apparently were damp when they were stored away, and this created a tremendous heat that automatically set them afire. The deadly smoke, some of the worst in my history as a fire fighter was caused by the waterproofing chemicals with which these tents were treated.
By the time firemen arrived the smoke was so dense that it had spread over half a dozen blocks. Second and third alarms were quickly sounded.
When the first firemen entered the basement, smoke drove them back. They forced their way in, and the majority of those overcome were in this detachment.
The casualties came so rapidly that extra hospital and police ambulances were called to handle the situation. However all the stricken men were taken to
Hospital
Clouds of Smoke Obscure Blazing Parish School
The school of the Church of the Transfiguration 55th St. and Cedar Ave. is enveloped by smoke during a fire in which many firemen were overcome this afternoon
List Inju Par
Flammable Canvas
Does it Again

FIRE CHIEF Finished Duck would have prevented this needless loss and damage—made unnecessary human suffering caused by poisonous fumes that overcame 16 firemen fighting this 3-alarm School Building fire.

Wherever unprotected canvas or even more dangerous flammable "waterproofed" duck presents a fire hazard from spontaneous combustion, carelessly thrown cigarettes, hot coals, sparks, hot rivets, welding operations, workmen's torches or other causes—FIRE CHIEF Finished Duck assures new safety.

Approved by the Underwriters Laboratories and the Factory Mutual Fire Insurance Companies, FIRE CHIEF also meets all Government requirements for a fire-, water-, weather- and mildew-resistant canvas.

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When Incendiaries Strike!! Use Waterfog

PREPARE NOW TO FIGHT INCENDIARY BOMBS. TOMORROW WILL BE TOO LATE.

These Rockwood WATERFOG Applicators (6 and 10 ft. sizes) which quickly wipe up vicious running oil fires also provide excellent protection against incendiary bombs.

Incendiary bomb fires are quickly put out with Rockwood WATERFOG applied with handy Rockwood WATERFOG Applicators or Nozzles attached to regular hose lines.

WATERFOG quickly absorbs the intense heat created by the incendiary bomb, wets down the surrounding area, protects the operator and enables him to move right into the heart of the fire. On incendiaries of the magnesium, thermit, or thermit-filled magnesium types, Rockwood WATERFOG *safely* accelerates the burning and the bomb is out in a few minutes—without scattering burning particles.

And, don't forget you have an almost inexhaustible supply of extinguishing agent—because Rockwood WATERFOG is just *ordinary water* broken up into millions of extremely fine droplets.

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Fire Alarm Box

Fire is the greatest destroyer of property, and DELAY due to inadequate facilities for transmitting alarms to the fire department is the greatest accelerator of the flames.

A reliable Fire Alarm Telegraph System with adequate box distribution protects property, gives the fire department a chance to keep losses small, and relieves the community as a whole from the responsibility for fire waste due to DELAYED ALARMS.

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AUTOMATIC SPRINKLER FIRE PROTECTION